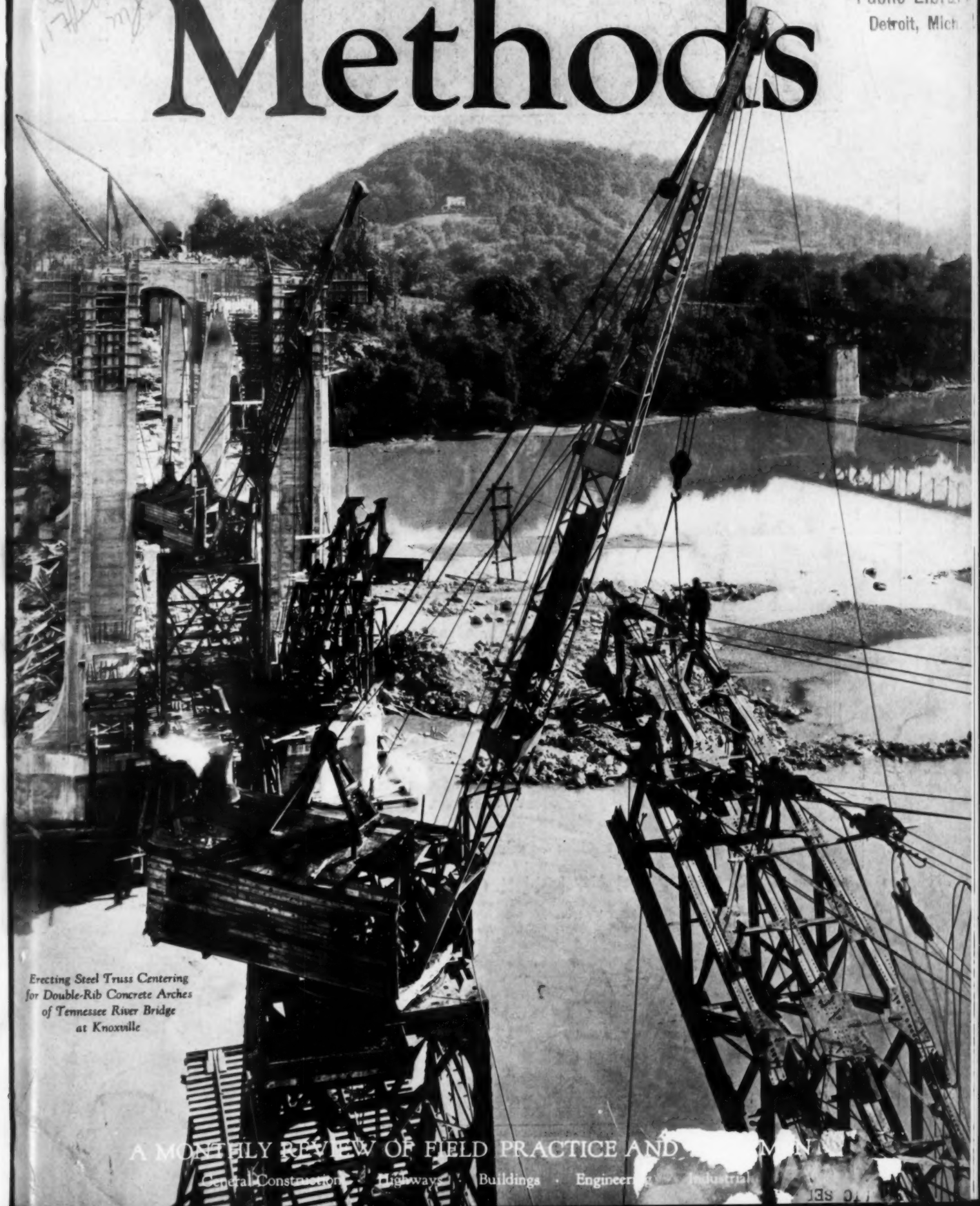
Construction Methods

April
1932

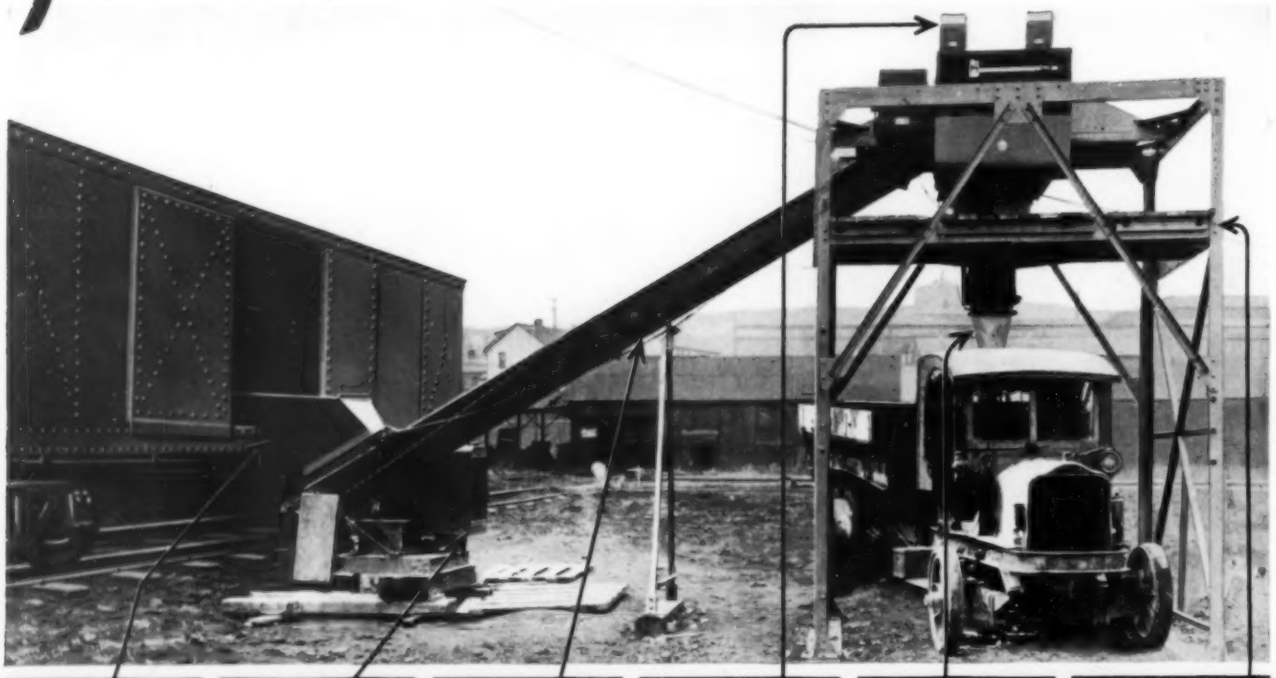


Erecting Steel Truss Centering for Double-Rib Concrete Arches of Tennessee River Bridge at Knoxville

A MONTHLY REVIEW OF FIELD PRACTICE AND MANAGEMENT

General Construction · Highways · Buildings · Engineering · Industrial

The BLAW-KNOX . . . *Low Cost* *Handy* BULK CEMENT PLANT



ADJUSTABLE TO CAR HEIGHT
Hinged car hopper for loading cement into screw conveyor.

AMPLE POWER
26 H. P. 4 cylinder gasoline engine with reduction gear and drive. Mounted on steel base.

NO DUSTING
12 inch inclined screw conveyor, completely enclosed.

SHIPPED ASSEMBLED
1000 pound Double Beam Cement Weighing Batcher with two springless dial indicators which show when batcher is full or empty.

CONTROLLED DISCHARGE
Canvas discharge chute from batcher to truck.

PORTABLE
Portable steel frame for support of Cement Weighing Batcher and screw. Includes operators platform with wood decking.

A new development—A Blaw-Knox BULK CEMENT PLANT equipped with vertical screw elevator for the cement—compact and portable.

A real inexpensive plant. It's portable—can be quickly set up and moved from job to job. There is plenty of clearance for trucks; no need to dig out for the driveway. Can be furnished with automatic control batcher if desired.

No bin required. The Blaw-Knox HANDY Bulk Cement Plant will operate fast enough to keep your job moving.

Blaw-Knox is thorough . . . painstakingly thorough, in designing its complete line of equipment for the storage, handling and batching of bulk cement. Plants of various types and sizes are available.

Complete detailed information and prices will be sent to you.

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Truck Turntables—Clamshell and Dragline Buckets—Ready Mixed Concrete Plants—Truck Mixers—ATECO Hydraulic Scrapers, Bulldozers, Scarifiers, Tamping Rollers

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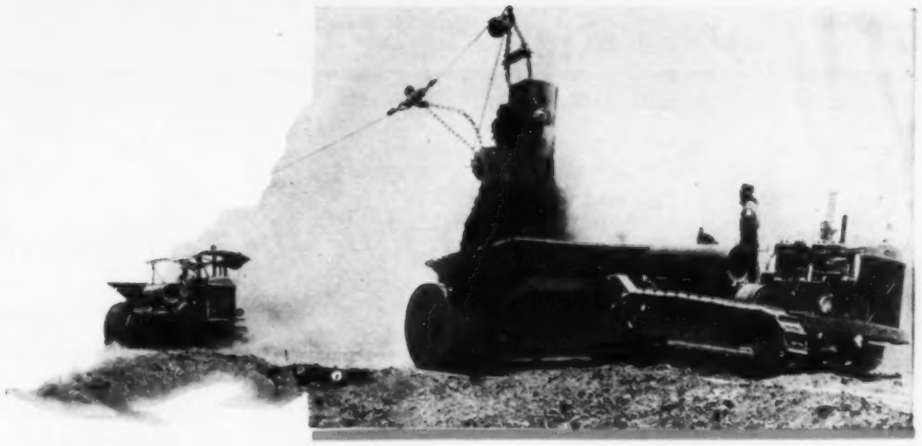
The Editor Notes -



To Improve Rock Grading

STUDIES of highway grading in rock, as recently reported by Andrew P. Anderson, of the U. S. Bureau of Public Roads, offer countless opportunities for coordinating the operations of drilling, blasting and removal of rock by power shovels. Present practice is indicted on evidence indicating a general absence of that grade of supervision, organization and matured planning which is given to the remainder of the job. Frequently all decisions affecting the location, spacing and depth of drill holes are left entirely to the drillers with the result that holes are placed where it is convenient to drill rather than where they will do the most good. This lack of planned direction usually extends also to the method of loading and the amount of explosive used. It is no wonder, Mr. Anderson states, that nearly three-quarters of all the rock jobs that were investigated reported the shooting as unsatisfactory from the viewpoint of fast, easy shovel operation. Under present close margins of bidding, the grading contractor who wishes to remain in business cannot afford to permit poor shooting on his rock jobs. He should realize that in highway grading the sole purpose of blasting is to break the rock into sizes that can be readily handled by the power shovel.

A New Detail in Brick Paving

When hot bituminous filler is flushed upon a brick pavement and squeegeed into the joints, there is always a certain amount of excess material that forms an objectionable, sticky film on the surface. A detail of construction technique that promises to remedy this trouble was employed in paving the roadway of the Washington St. memorial bridge at Wilmington, Del., described on page 22 of this issue. Here the expedient was tried of applying a coat of whitewash to the brick surface before the bituminous filler was applied. The whitewash served to prevent a bond between the excess filler and the brick surface, allowing the excess filler to be scraped off after jointing operations had been finished. The method not only produced a clean surface but resulted in a saving in cost inasmuch as the excess filler that was scraped off, after mixing with an equal amount of new asphalt, was reheated and used again.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD
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A Directory of Responsible Contractors

For those responsible for the award of contracts, whether they be engineers, architects, public officials or company executives, it is good news to know that the Bureau of Contract Information, Inc., of Washington, D. C., has compiled a directory of contractors who have filed records of performance on work previously done. When bids are received it sometimes happens that the low figure is submitted by a company about whose financial responsibility, integrity, and construction skill little or nothing is known or can be readily found out. Under these conditions a decision as to the award of the contract becomes largely a gamble. The awarding official, of course, desires to get the job done at the lowest cost, but at the same time he is averse to turning the work over to a contractor without experience in the type of construction contemplated or with a record of past performances that will not bear investigation.

To prevent costly mistakes in the letting of contracts to irresponsible bidders, awarding authorities should take full advantage of the reliable and timely service that the Bureau of Contract Information offers, without charge.

New Building Methods and Materials

Not wage cuts alone, but the use of new methods and materials of construction and the mechanization of the industry generally, will bring about a revival of building, Andrew J. Eken, vice-president of Starrett Brothers & Eken, Inc., told members of the American Institute of Architects at a meeting last month. A number of companies, he said, are developing partitions in panel sections which will eliminate plastering. They can be quickly erected by unskilled labor and while fireproof, soundproof and non-heat-conducting, will be considerably cheaper than terra-cotta block plastered partitions. These unit sections are being developed over a wide range of material, including gypsum, aerated clays and slag byproducts, all attractive and reducing the dead load on the structure with attendant saving in cost.

New doors, as little as $\frac{1}{2}$ in. in thickness and of a new composition, are being developed. To supplant the cinder arch, similar studies are being made in precast slab units which will require no plaster.

The present heavy exterior masonry walls may also be eliminated, according to studies mentioned by the builder, by using lightweight materials of low heat-conducting qualities and of only 2 to 4 in. in thickness. Units to eliminate the maze of duct work now necessary in buildings and to heat, filter, ventilate and condition air and banish street noise at a saving in cost are also in the making.

To Deflate the Deflationists

IN much of the propaganda designed by real estate and banking interests to throttle municipal public works, we sense a purpose to conceal realities behind a terrifying smoke-screen of vast total expenditures. It's too much money they tell us; deflation must become the order of the day!

All right; let us begin by deflating some of these deflationists and their intimidating statistics.

We have been told, for example, that municipal expenditures today are six times as great as they were thirty years ago and that this proves extravagant waste of the tax-payers' money. And to be sure, it sounds like a big jump.

But our associated journal, *Engineering News-Record*, is publishing a series of articles that seek to analyze some of these totals and to find out what actually has happened to the cost of establishing, operating and administering the modern city.

In a study of 146 cities of more than 30,000 population, analysis shows that while the total expenditures increased from 1903 to 1929 by 482 per cent, the natural growth of those cities reduced the increase *on a per capita basis* to only 216 per cent. In other words we are comparing the costs of running two enterprises of considerably different magnitude.

Furthermore, we are forgetting that during that period our cities have become less and less purely governmental agencies; of necessity, they have been required by the growth in the needs and standards of urban living to provide many additional community facilities and services. These are essential; if the city had not provided them some other agency would have, and the consuming citizen would have had to pay someone for them.

Then, too, in making such a comparison, we ignore the effect of changes in the value of the dollar. The analysis brings out clearly that when these corrective factors are applied to effect a true comparison, the increase in the per capita cost of purely governmental functions has been only 6.5 per cent, of maintenance and operation of the steadily increasing list of community services only 50 per cent; and from the peak of 1911 to that of 1927 the annual per capita investment in permanent improvements to provide these services increased only 6 per cent.

But this page is not the place to review these instructive articles. The point is that most of the extravagant demands for municipal retrenchment are but sound and fury that signify nothing. If we *must* economize for the time being, let it be done sanely without blind slashing at municipal budgets. Let us not, on a false premise, incur the risk of paralyzing the development and operation of community services so essential to the health, security and convenience of the modern city.

The thoughtful citizen, in whatever walk of life, will not be stampeded into supporting so disastrous a policy.

Willard Chevalier

Publishing Director

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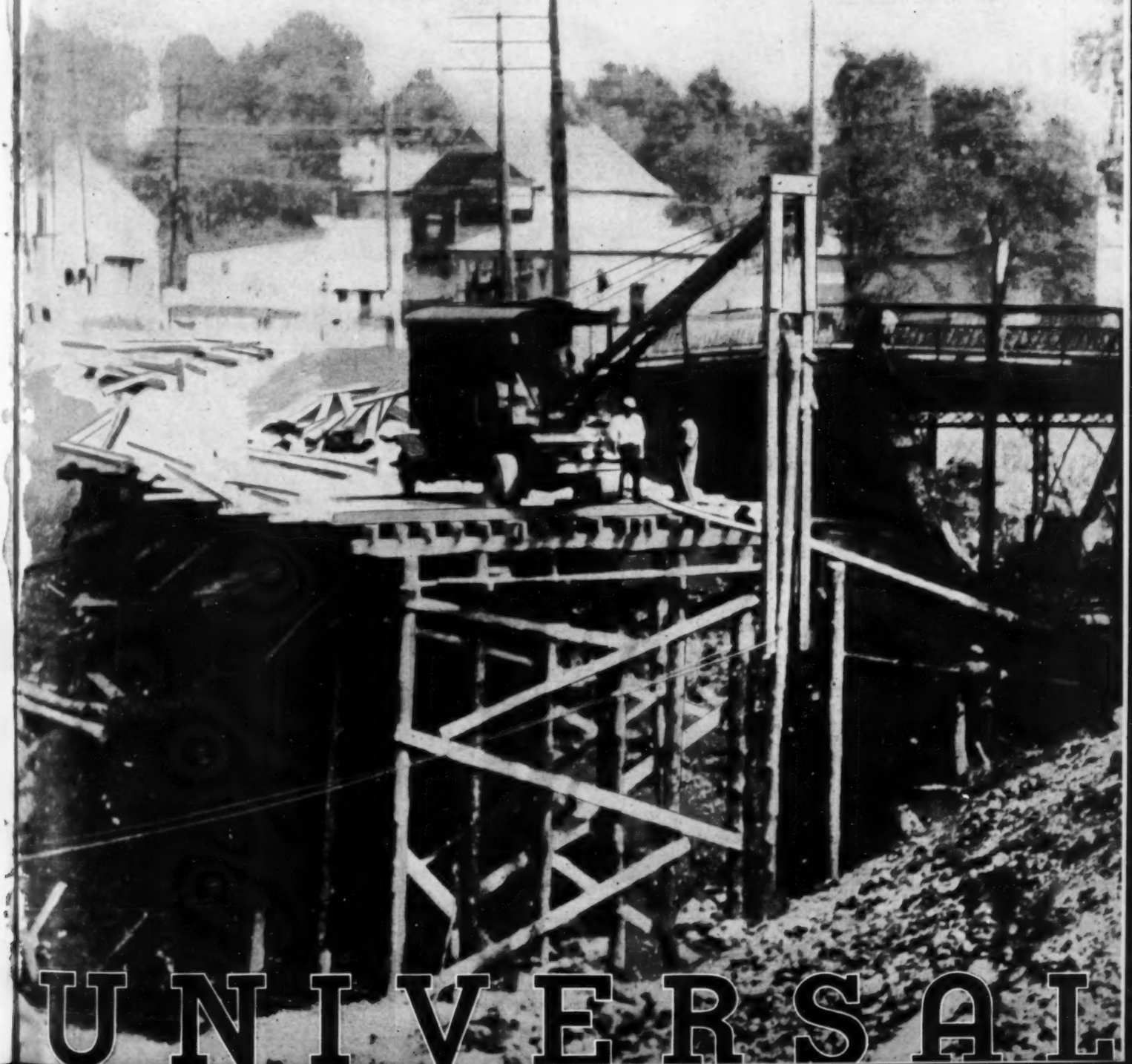
THE BRIDGE BUILDER

Cutting costs on bridge building means working faster—tying up less investment in equipment. Hence, the popularity of all-purpose Universals on bridge building. Universals build detour bridges, make channel changes, dig abutments, drive piling, place falsework and timbers, erect steel, unload cars, charge bins, place concrete buggies, dismantle forms, grade approaches. Universal's motor truck mounting will even tow trailers of loaded equipment from job to job, saving freight costs, getting there faster.

UNIVERSAL CRANE COMPANY, LORAIN, O.



UNIVERSAL

A *Plain* STATEMENT about Roebling Rope economy

Recently much has been published regarding the service and economy of wire ropes.

For the guidance of rope buyers, therefore, Roebling desires to make the following statement, concerning the operating cost of its ropes, backed up by their performance in actual service over a period of many years:—

"Roebling does assert that when gauged by the work performed, NO wire rope, regardless of make or construction, will show lower general average operating costs than Roebling."

If you are not a user of Roebling Rope we invite you to try it—to see first hand evidence of its great stamina. We do not ask you to accept the service record of a single rope as conclusive proof of the general performance of Roebling Rope. Put Roebling Rope to the only reliable and most exacting rope service test:—judge it on the basis of its *average* cost per ton of material handled, per miles of travel, or other unit of service measurement.

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Wire · Wire Rope · Copper & Insulated Wires & Cables · Welding Wire · Flat Wire · Wire Cloth & Wire Netting

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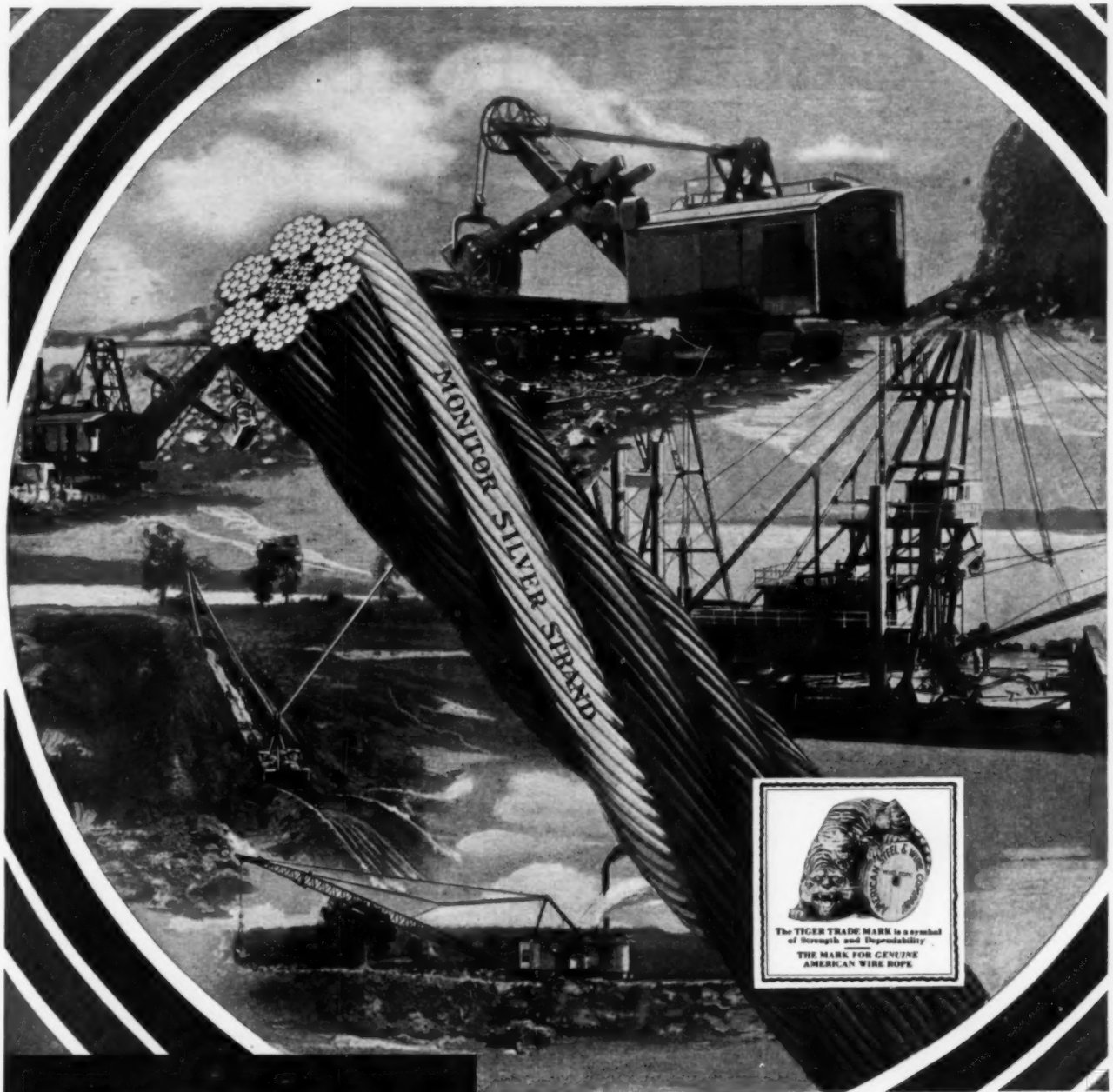
Wire Rope for all purposes

There is no such thing as a wire rope "cure-all". No one design of wire rope is suitable for all purposes. ¶ Roebling makes wire rope of a great variety of types and constructions, and therefore can supply a wire rope exactly suited to each particular requirement. ¶ The great stamina of all Roebling Ropes is primarily due to the quality of Roebling Wire. This Acid Steel Wire is renowned for its fatigue and wearing qualities. No better rope wire is produced. ¶ "BLUE CENTER" STEEL is the highest grade and is generally recommended for severe duty.

JOHN A. ROEBLING'S SONS COMPANY



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Car Owners Avoid

THURS. — BRIDGE OPENED TO TRAFFIC

TUES. — CONCRETE POURED

66 Other Jobs Contained in "New Facts About 24-Hour Cement"

The bridge repaving job across the Passaic River at Newark again shows economies and savings through the use of 'Incor' 24-hour Cement. Twelve days of detouring were eliminated. Motorists saved $16,000. "New Facts About 24-hour Cement" (shown on opposite page) includes this and 66 other stories of actual savings. 87 copies of this book are available. Let the 'Incor' salesman show you parallel jobs — and the savings 'Incor' can effect.

12-Day Detour— Saving $16,000

Bridge reopened within two days

Bridge repairing, on a main thoroughfare, presents serious problems for engineer, contractor and the motoring public,—problems that can easily be solved with 'Incor' 24-hour Cement. Here is an example:

The Bridge Street Bridge, crossing the Passaic River at Newark, carries a traffic volume of 17,000 vehicles a day—25% trucks. The repaving of the bridge-floor with ordinary Portland cement would have closed this busy bridge to traffic for 14 days.

The nearest available bridge, one-half mile away, was already overtaxed. This detour would have imposed an extra mile of travel and at least six minutes' delay per vehicle. Traffic interference had to be minimized.

Each $1 Spent Yields $32 Saving

Essex County Engineers solved the problem by using 'Incor' 24-hour Cement. Instead of 14 days, this bridge was closed to traffic for two days only.

Detour operation expense and lost time were saved. While 'Incor' costs slightly more than ordinary Portland cement, the savings on this job alone were $32 for every added dollar spent for 'Incor.'

66 Other Savings Stories in New Book

The Newark Bridge is only one of 67 stories about the economical performance of 'Incor' on all types of concrete work. "New Facts About 24-hour Cement" contains the most striking information about cement ever printed.

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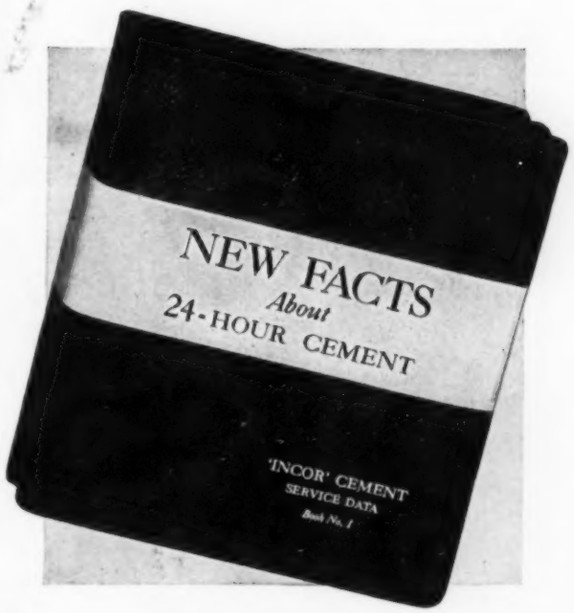

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SAVINGS—

Link-Belt—the "high altitude" shovel. Working 8000 to 9000 ft. above sea level, where the normal loss in power is 28%, and in rock slides and boulders, this 1½ yd. K-44 shovel is proving its worth for its owners, Robertson-Roberts Co., of Los Angeles.

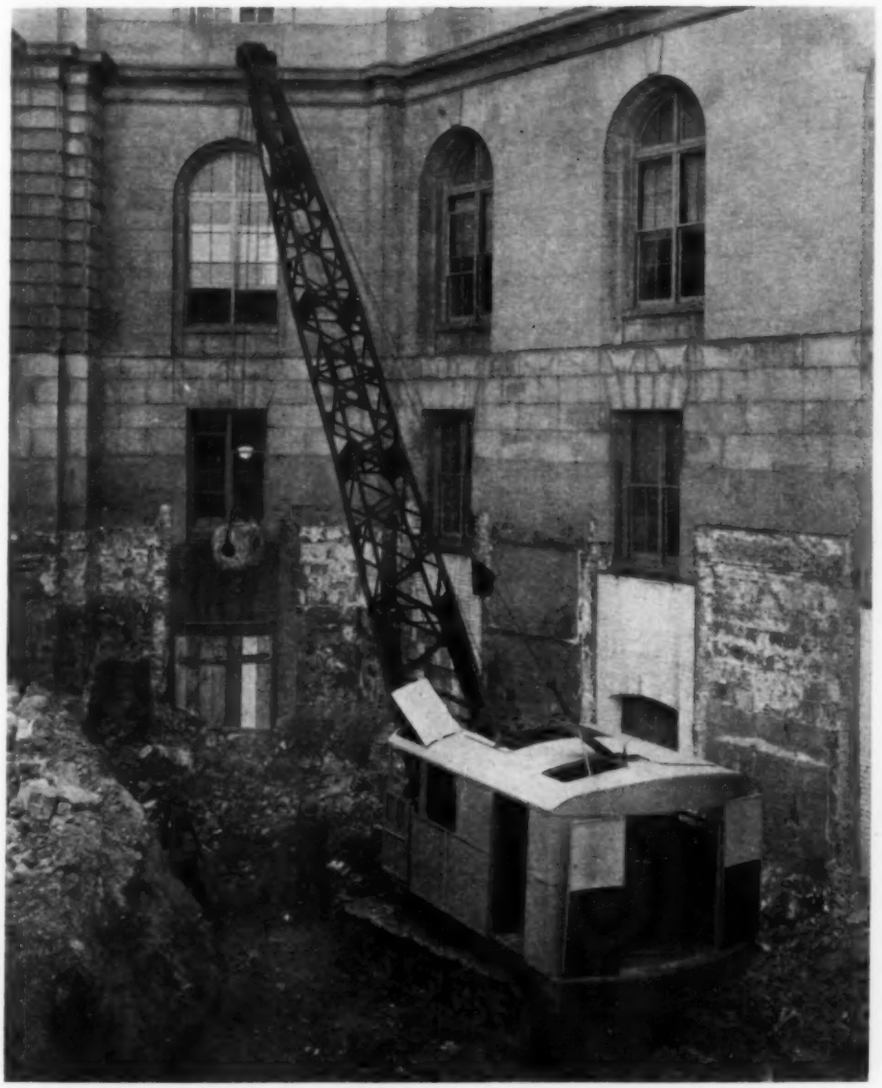
K-48—the new Link-Belt with 50-ft. boom. Operated by John Griffiths & Son Co., Contractors, Chicago, on excavation work for the Sanitary District of Chicago.

Buffalo Marine airport built with the aid of this Link-Belt K-30. Used as a shovel, pile driver, dragline and crane. The illustration shows it placing concrete with bottom dump and tip over buckets.

On a highway job along the west shore of the Mississippi, in Iowa, three Link-Belts are used by Paul Betz. He says, "Your shovel is the last word when it comes to removing rock, etc."

LINK-BELT

on the Day's Work!



In the capital of the U. S., a Link-Belt K-30 beside the Senate office building, ready to break away old foundation of brick and stone with a 2-ton weight, preparatory to structure's enlargement. B. F. Diamond, Baltimore, doing the work.

Out of this predicament, comes this Link-Belt, under its own power, after drying out the magneto and installing a new battery. A heavy rainfall had washed the foundation out from under one side of the machine.

"I am more than pleased with my Link-Belt Dragline. During the four months we have been operating we have not lost a minute on account of the machine and, with the exception of a few fairleader bushings just bought, I have not spent a penny for parts." So says Wm. Ray, Pensacola, Florida, of this Link-Belt K-30.

1416 yds. in a day, with this Link-Belt ¾ yd. shovel, in the building of this road in Alabama. Brackin Construction Co., Sub-contractors.

YOU can bid lower on your next job if you will use the Link-Belt shovel-crane-dragline. ¶Built in sizes from ¾ to 2½ yd. capacity, *heavy-duty*, the Link-Belt digs more yards per month, *for more months*, at less cost. ¶It is rugged, powerful, simple. Easy to run, fast all day. Shock proof main castings of annealed steel; larger well oiled parts. Big smooth-acting clutches and brakes. ¶If you want low cost performance get our proposition.

LINK-BELT COMPANY
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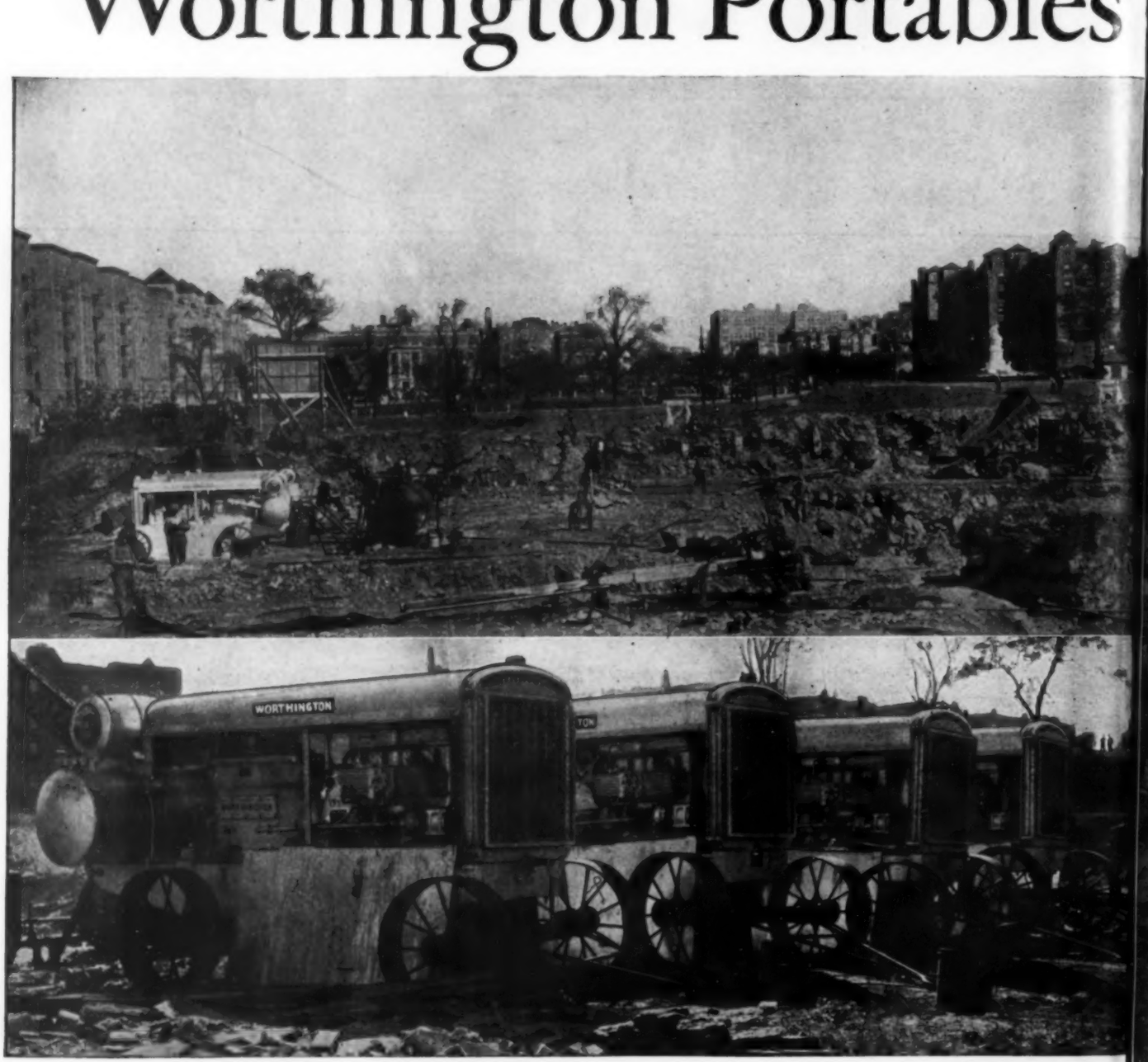
SHOVEL-CRANE-DRAGLINE

Worthington Portables



IN excavating for the Bronx County Court House, in New York City, William Kennedy Construction Company used four Worthington 330 cu. ft. *Air King* Portable Compressors. This equipment furnished air for all the rock drills and pavement breakers employed.

The machines were hooked up in tandem with one unloader to each pair of units, giving the advantages of two 660 cu. ft. stationary machines without the drawbacks of weight and cost. Air was pumped to an auxiliary receiver from which it was piped to the entire job.

Investigate the Worthington line of compressors and air tools. Their advanced engineering features are helping contractors and maintenance departments to reduce costs and to speed up operations. *Call the nearest Worthington distributor or district office.*

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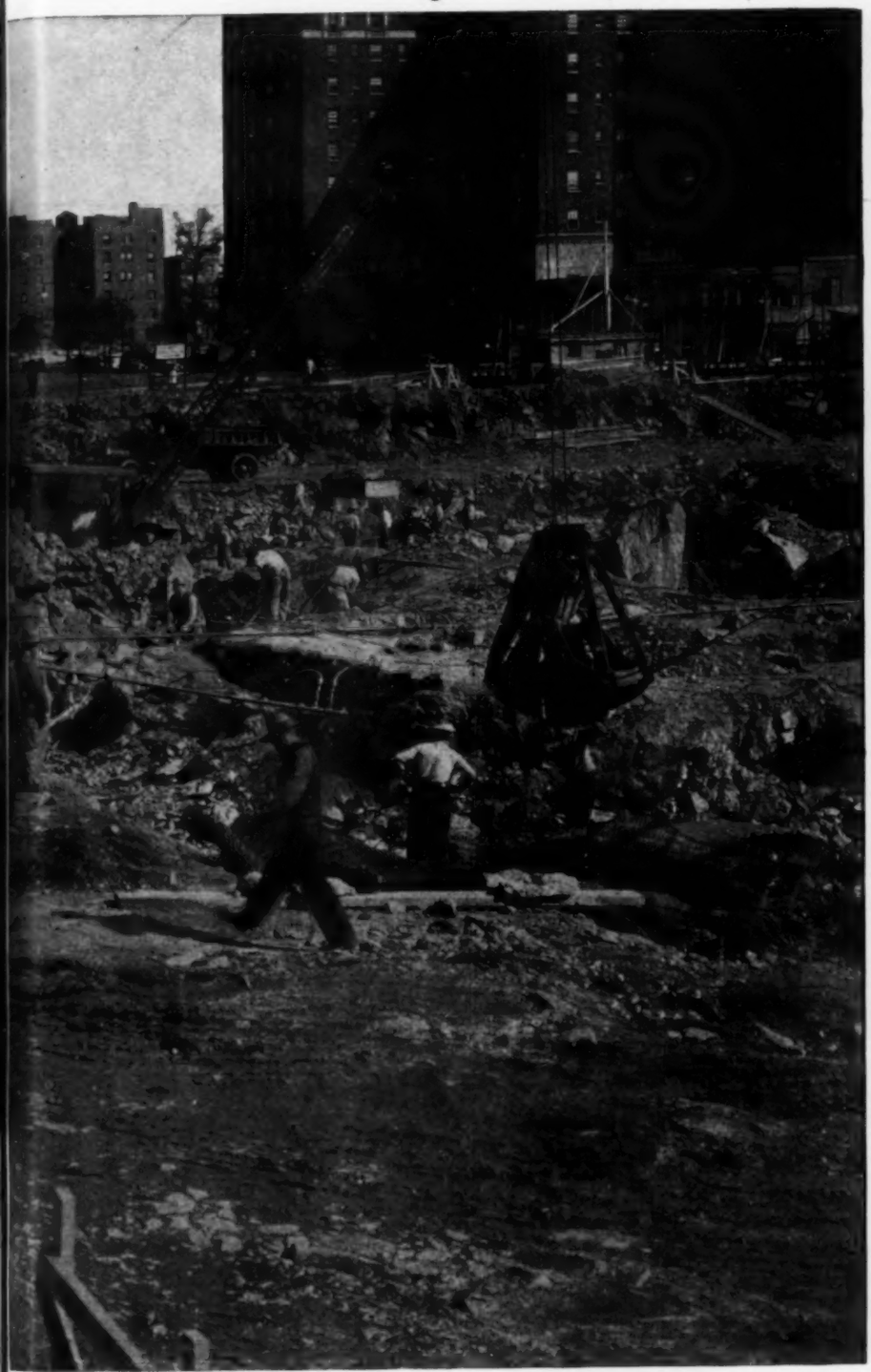

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Portable—Gasoline engine, fuel oil engine or electric drive; skid, trailer, motor truck, tractor or rail car mounting

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Complete units comprising Goodyear Emerald Cord Belts operating in grooved sheaves

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1020 ½-yard	21-B ¾-yard
32-B 1-yard	37-B 1¼-1½-yard
43-B 1½-1¾-yard	52-B 2¼-yard

GA-3 1¼-yard Gas + Air
Convertible Shovels

Construction Methods

ESTABLISHED 1919—McGRAW-HILL PUBLISHING COMPANY, INC.

ROBERT K. TOMLIN, *Editor*

VOLUME 14 NEW YORK, APRIL, 1932 NUMBER 4

COMPLETED SECTION of concrete flume for Milner-Shoshone canal in Idaho.

TIMBER JUMBO, designed by contractor, moves forms ahead for concreting new section of flume.

TIMBER JUMBO MOVES FORMS

for Concreting Irrigation Flume

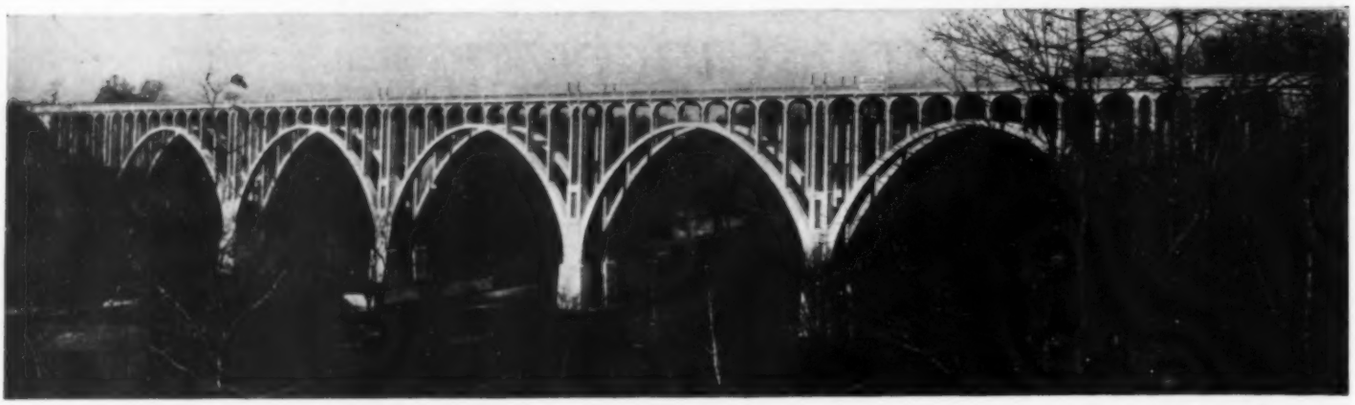
CONCRETING a 3½-mi. section of flume for the Milner-Shoshone canal, part of the U. S. Bureau of Reclamation's Minidoka project in southern Idaho, was expedited by the use of a timber jumbo for placing and moving the forms and carrying the mixer, as illustrated in the accompanying photographs. The line ran through lava rock which caused the contractors much trouble in blasting and removing with a pair of dragline machines.

The section of canal illustrated was built jointly by the Morrison-Knudsen Co. of Boise, Idaho, and the Utah Construction Co., for whom the superintendents were, respectively, L. S. Miles and B. P. Aird. The work consisted principally of concrete flume, with some Gunite and rubble masonry construction. Operations were handled from headquarters at shoshone.

"With the movable forms," Mr. Aird reports, "the pouring of the concrete went along without a hitch and work was completed a week ahead of schedule, despite the fact that we had to shoot a large portion of the canal a second time."

LAVA ROCK, requiring blasting, was encountered on route of canal. View shows wood forms set in cut.

POURING OF CONCRETE into wall forms was done from mixer mounted on movable jumbo.

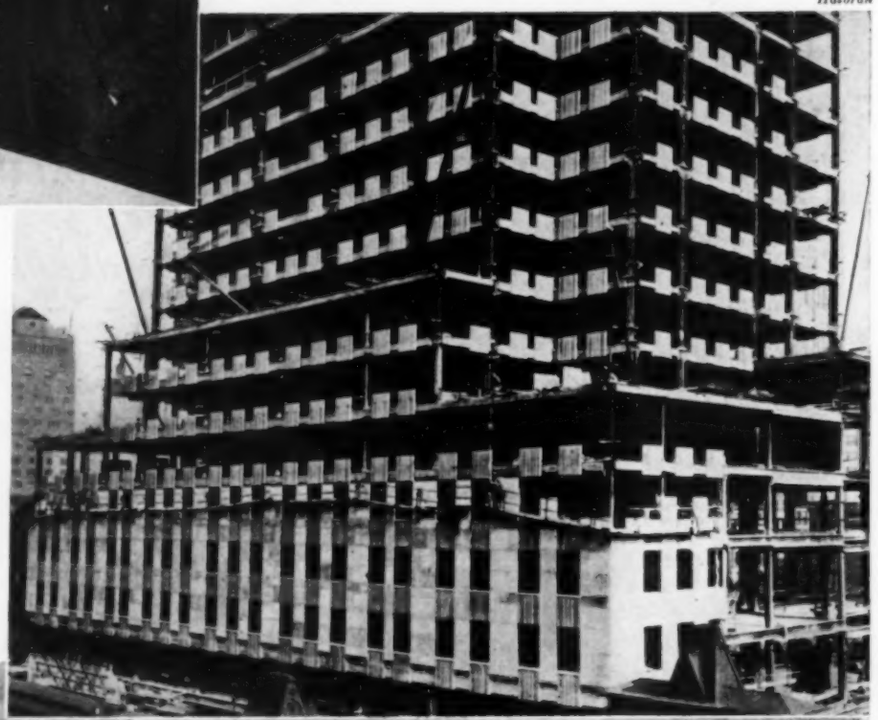


OHIO'S HIGHEST STATE HIGHWAY BRIDGE. Open-spandrel concrete arch structure, 164½ ft. between footings and grade line and 1,132 ft. long, crossing Cuyahoga Valley at Brecksville, was recently completed by Highway Construction Co., of Cleveland, at cost of $426,000.

This Month's "News Reel"

SAFETY CONTEST AWARDS made by Associated General Contractors. *(Left to right)* W. F. Tubesing, committee vice-chairman, presents chapter cup to W. F. Creighton, representing Louisville chapter. F. V. Ragsdale receives Horst cup for George H. Rommel Co., Louisville. W. R. Richards, A. G. C. safety director. B. L. Knowles represents John J. Powers Co., Worcester, Mass., winner of Goble cup.

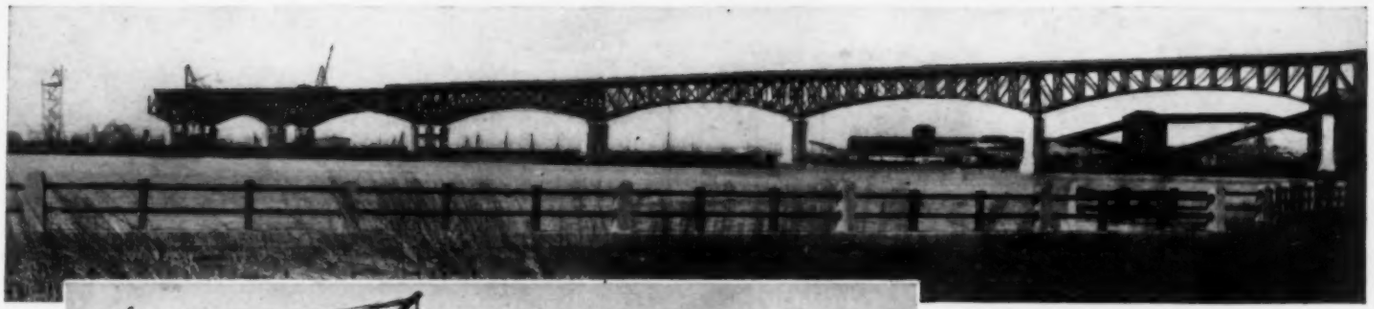
Halbran

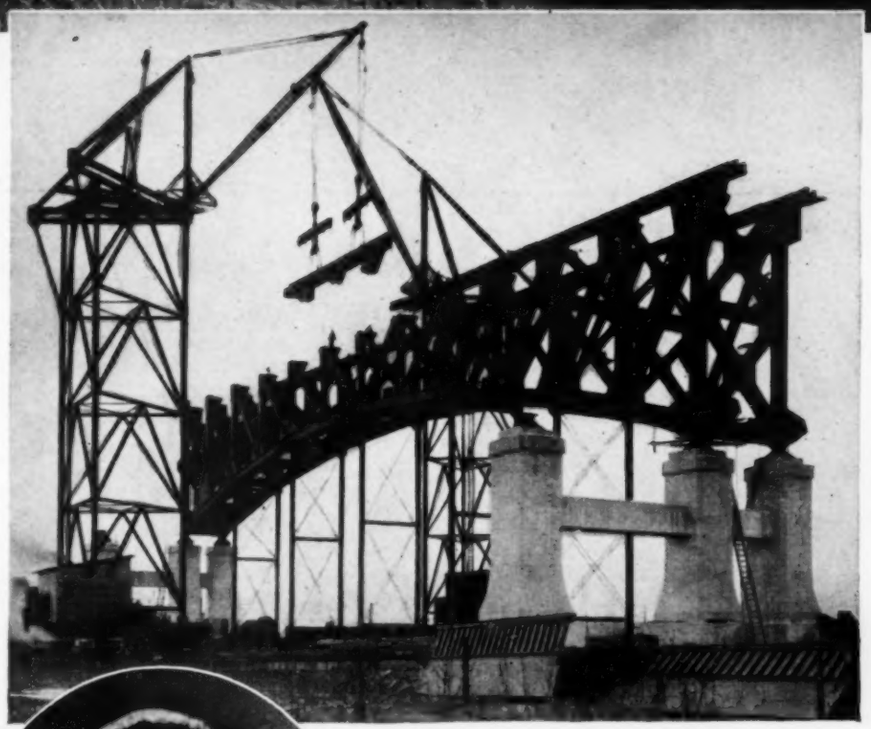


ALUMINUM SPANDRELS *(right)* are being set on steel framework of 31-story RKO building for Radio City (recently rechristened Rockefeller Center), New York. Masonry portion of walls of structure under construction by John Lowry, Inc., building contractor, will be of gray and buff limestone.

Wide World

ANOTHER SECTION OF WEST SIDE ELEVATED EXPRESS HIGHWAY along Hudson River waterfront, New York City, has been placed in service between 59th and 72nd Sts. James Stewart & Co., built superstructure.



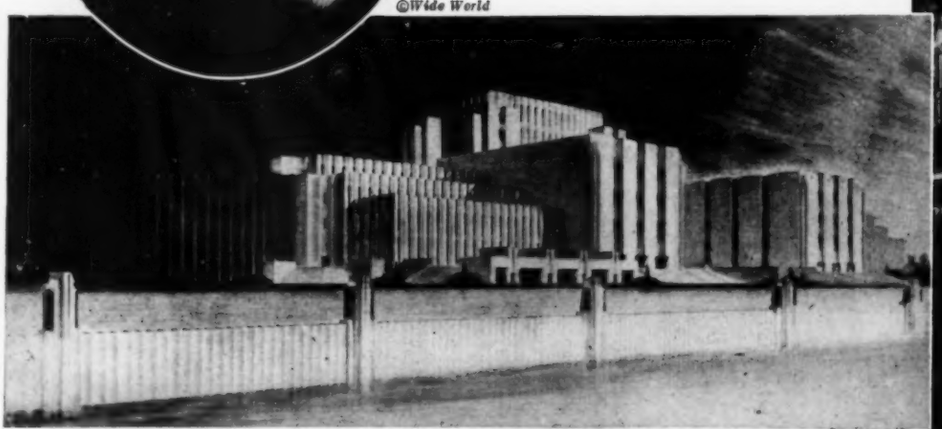


ACROSS JERSEY MEADOWS *(above)* long structural steel viaduct for highway traffic will link Jersey City and Newark, providing direct route to New York via Holland Tunnel. TOP CHORD PIECE *(left)* 63 ft. long, weighing 55 tons, is being set with tower rigs by Phoenix Bridge Co. in center truss of three-truss span 270 ft. long. Each of two structural steel tower rigs 122 ft. high from top of rail to heel of boom and operating on two pairs of standard-gage track spaced 28 ft. 7 in. on centers, carries 40-ton Clyde stiff-leg derrick with 75-ft. boom. Each tower complete with derrick and counterweight weighs 225 tons. During erection, span is supported on five 2-column steel falsework bents set on sand jacks. Each column designed to carry 140 tons. Distance from ground to center line of top chord is 100 ft. The section of the viaduct illustrated is being erected by the Phoenix Bridge Co., for the New Jersey Highway Commission of which J. L. Bauer is chief engineer.

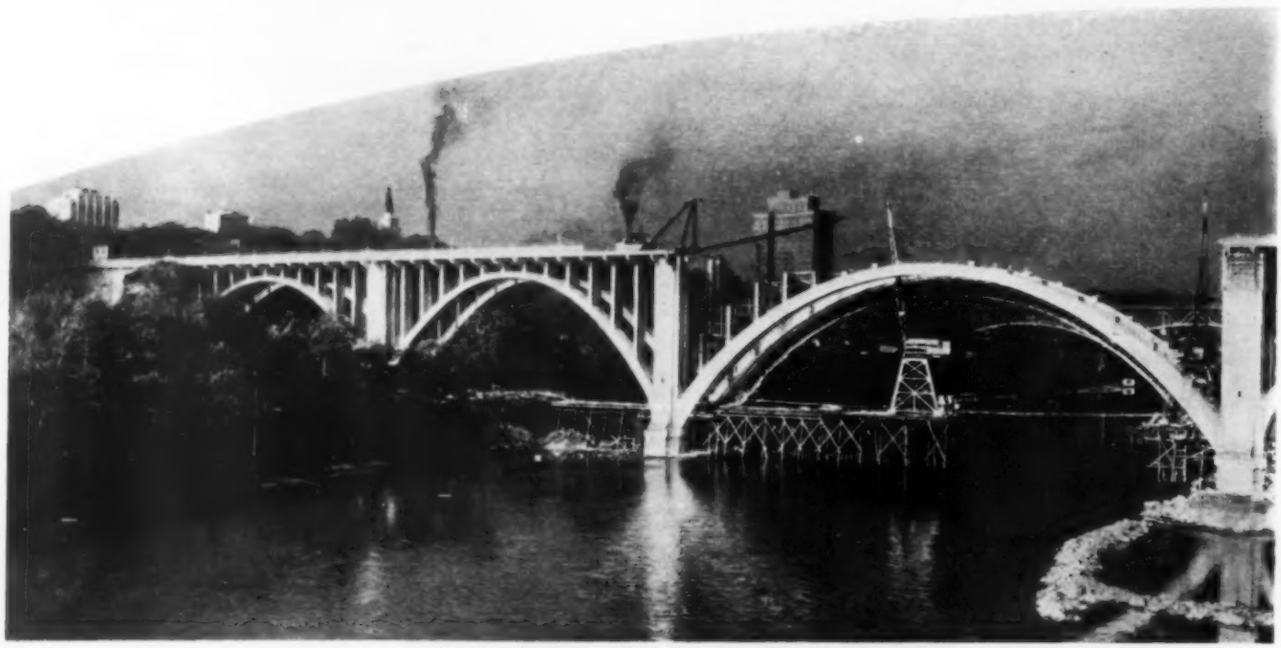
Photos from
J. F. KINTER
Superintendent of Erection,
Phoenix Bridge Co.

©Wide World

DOUBLE-DECK ELEVATORS operating at 1,000-ft.-per-minute speed, serve new 67 story Cities Service Building *(right)* rising to height of 950 ft. in downtown New York. Vertical transportation system consists of 26 Otis elevators, including 8 double-deck cars of signal control, micro-leveling type, in addition to 10 escalators. The two compartments of each double-deck elevator are supported by one structural steel frame 25 ft. high.



WINNING DESIGN for Palace of the Soviets, Moscow, nets $6,000 prize award for American architect, Hector O. Hamilton *(in oval)*, of New York.



BUILDING CHANNEL SPAN over Tennessee River. Long-boom whirleys of stream, with 100-ft. channel unobstructed. Traveling

Double-Rib Arches of Tennessee REPEATED USE OF

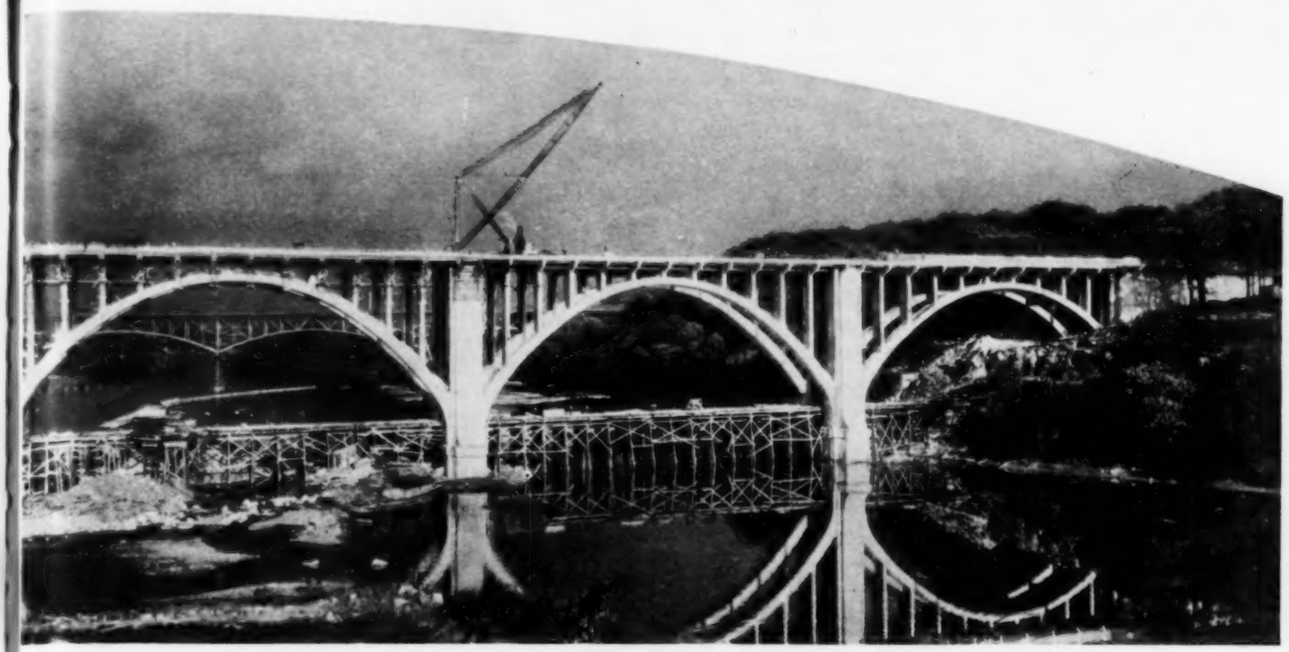
STEEL-truss centering used repeatedly in the construction of long-span double-rib arches on a highway bridge 1,795 ft. in length over the Tennessee River at Knoxville, coupled with duplicate outfits of portable equipment working from both ends toward the middle of the structure on a low service trestle between the arch ribs and columns of the piers, enabled the Booth & Flinn Co., of Pittsburgh, to make fast time economically. Use of concrete delivered to the job in agitator trucks from a local ready-mixed plant also was an important factor in getting the job done quickly. This source of concrete eliminated two complete mixing plants.

The Henley St. bridge, carrying a 54-ft. roadway with a 6-ft. sidewalk on each side, was built jointly for the city of Knoxville and Knox County. Since the Tennessee River is navigable at the site, it was necessary to provide a channel span 297 ft. in the clear. This span is flanked on each side by spans of 212 ft., with two shorter spans extending to the approach at one end and one at the other end, making six in all.

Federal government requirements called for an unobstructed opening of 100 ft. under the 297-ft. span during construction. Hence, it was necessary to carry on operations from both banks of the stream. Public and private improvements along the right bank limited the space available at that end for plant set-up and material storage. A range of 45.5 ft. from record high to record low water in the river, with floods common at least once a year, made the use of falsework to carry centering for the arch impracticable. George Hockensmith, vice-president and general superintendent of Booth & Flinn Co., accordingly conceived the idea of the fabricated steel centering to be reused several times, independently of falsework.

No provision was made in the design of the bridge for offsets in the piers at the springing lines of the arches on which centering might be shored during construction. Nor did the specifications indicate how the bridge was to be built. By close cooperation between the contractor's organization and the McClintic-Marshall Corporation, which designed and fabricated the centering, the latter was detailed to be built in sections that could be assembled on the job to suit the five different span lengths and five radii that were in-

TRAVELER, built of two sections of steel centering for arch ribs, operates on rails shored up from completed pair of ribs and floor columns of each end span to support shore end of centering in making shift from first to second span at each end of bridge.



mounted on tall gantries travel on service trestle extending out from each bank stiff-leg derricks at street level place deck and hand rails.

River Bridge Are Concreted by STEEL CENTERING

volved in the bridge. Support for the centering that was entirely independent of the stage of the river was obtained by brackets of structural steel set in the permanent piers at the springing lines of the arches.

Little trouble was encountered in building the piers, except one in the middle of the stream for which the excavation had to be carried down through loose rock and bad ground to 42.5 ft. below low water. Operations on the piers were carried on from the ends of the service trestle, or from floating equipment.

Construction of the ribs for the two end spans was started at about the same time, after the approaches and the first two piers were far enough along to permit the erection of the steel centering for these ribs. Both these end spans are unsymmetrical. Sections of the three-hinged steel centering were designed to take care of this unbalanced feature.

As soon as one of the ribs of the pair in each end span was poured, the centering was lowered slightly by means of heavy erection jacks under the two end hinge bases. Then the assembled center was shifted transversely across the structure and raised to postion under the second rib of the end span.

When the two ribs of the end span were finished, the problem was to shift the centering back to the axis of the bridge, move it ahead through the columns of the pier and place it in position to carry the forms for one of the two ribs of the second span from that end. This was done by suspending the shorter unsymmetrical end of the centering from a traveler running on rails shored up from the completed ribs of the first span, while the other end of the centering was supported on a traveler dolly running on a timber trestle built up higher than the trestle serving the rest of the job.

Two conditions complicated this shift: In the first place, the second spans are longer than the first ones. Secondly, the springing lines of the channel ends of the second spans are lower than those of the first arch ribs. This meant that in shifting from the first to the second span the unsymmetrical centering had to be lowered at one end, and the other end extended to add the required length.

This was done in two steps. First,

OFF-SHORE END OF STEEL CENTERING for first pair of arch ribs at each end carried by traveler dolly on trestle through pier columns between first and second spans. Load of this end of centering was transferred to second dolly, shown directly under hinge, for balance of move for this lengthwise shift. Then upper dolly moved back to take load of other end from overhead traveler.

the centering was run ahead until the outer end of it was beyond the outer end of the trestle at the upper level. Then the base carrying the hinge at that end was removed, the lengthening section inserted and the hinge base returned to place at the end. This permitted the load of that end of the centering to be shifted from the dolly on the upper trestle to one on the lower trestle. Then the other end of the centering was lengthened, after which its load was shifted from the overhead traveler to the dolly on the upper trestle, which had been shunted back to take it.

With both ends of the centering on the dollies the move was made on out to clear the pier. Then the centering was lowered on a steel grillage placed crosswise of the bridge on the structural brackets built temporarily into the permanent piers, and shifted transversely into position to carry the forms for the first of the two ribs of the second span.

When the first rib was finished the transverse shift to the second rib was made on the grillage. To build the ribs of the third span out from the right bank of the stream the centering was shifted to the axis of the structure and then moved forward to clear the pier. In this position it was extended by the addition of more sections to get the right span for the third arch from that end. Then the procedure was the same as on the second spans from each end.

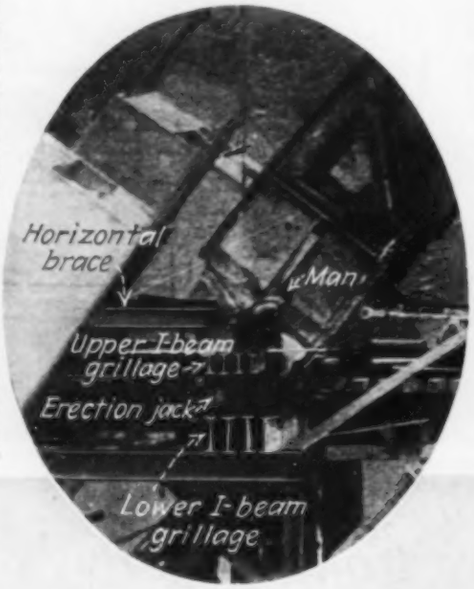
On account of the larger loads to be carried in building the 297-ft. channel-span arch ribs, the set of centering that had been used at each end of the structure was dismantled and re-erected as a three- instead of a two-truss structure which had been sufficient for the other spans. This dismantling and re-erection was done in midstream by a pair of 80-ft. boom full-circle-swing gantry cranes running on the service trestle across the river under the structure.

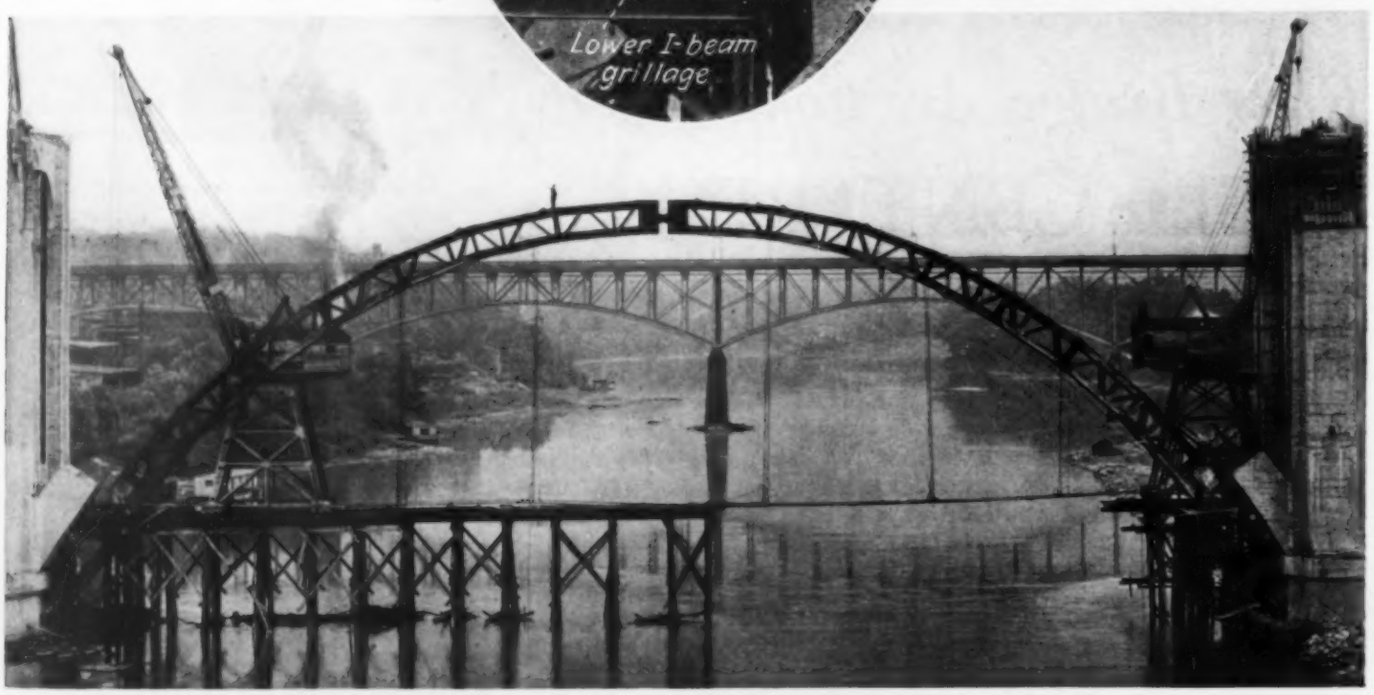
In re-erecting for the 297-ft. span, the hinge bases for the two ends were first set on the grillages on the brackets extending out from the piers. Then the truss sections were added by the gantries. As each section was set it was anchored back over the top of the adjacent permanent pier to the grillage on the other side. When the next section was placed and attached to the preceding one, the cable guys were used to transfer the whole load of that end of the centering to it. Working in this manner, the two ends of the centering truss were carried forward at the same rate. When the last two sections were placed at the crown, the hinge casting there was set and the closing made without difficulty by men working with the crews of the gantries.

By this method the 180 tons of steel in the centering for the channel span was erected in seven days. When it was ready the forms for the rib were erected on it and poured. Operation records on this span give an idea of the speed with which this part of the job was handled. The steel centering was ready for the first rib on a Thursday. By the following Monday morning the forms had been erected and pouring of the 900 yd. of concrete in this rib was started. Two days later the rib was finished. After this rib had set 7 days the centering was lowered and shifted to the second rib. The latter was poured within three days after the centering was in place for it. To facilitate this fast work, the key sections of the arch ribs were made of richer concrete.

Transverse shifting of the centering from one rib to the other of a pair was done by jacking on both ends simultaneously at exactly the same rate. A steel plate under the hinge base at each end took bearing on heavy erection jacks resting on the steel grillage carried by the structural brackets on the piers. No trouble was experienced in shifting the heavy centering either

END HINGES *(below)* **of steel centering, showing structural bracket on which centering was shored and grillage of two sets of I-beams on which transverse shift from one to the other of each pair of ribs was made. Heavy erection jack gave the vertical motion necessary to get exact position.**

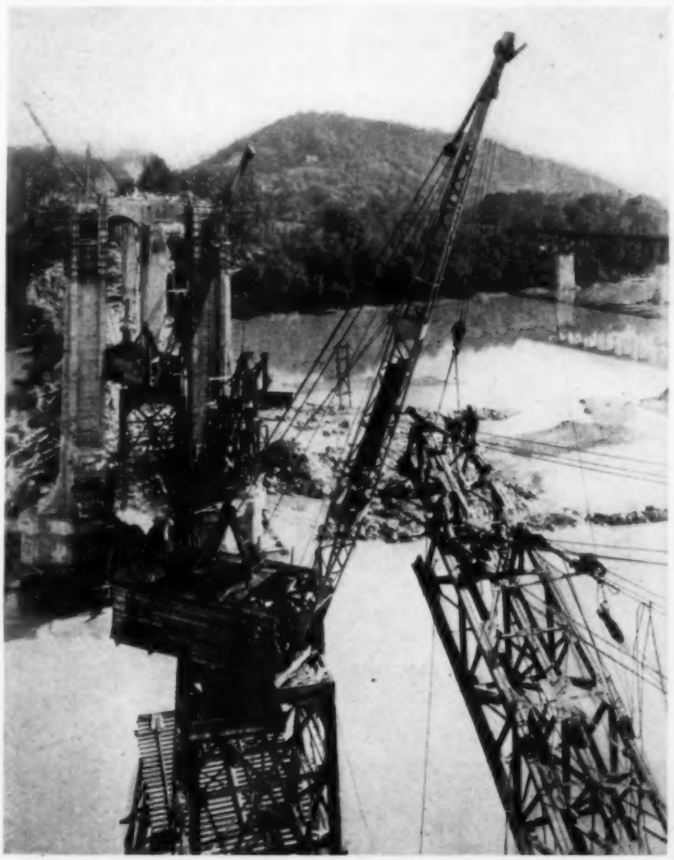




THREE-HINGED STEEL CENTERING in place for 297-ft. channel span across Tennessee River. Service trestle carries gantry-mounted whirley crane.

crosswise or lengthwise of the structure. Ordinary hand-operated jacks were too slow for the cross moves, but a special jack for this class of work that was substituted proved very effective.

Ball-bearing mountings in the dollies rendered them easily responsive to pulls for moving the centering lengthwise. By proper use of guys there was never any chance of the centering getting out of control while in motion.



GANTRIES *(left)* on service trestle erect centering for arch ribs and also handle concrete delivered by agitator-body trucks from ready-mixed plant.

Risk from tipping over also was practically eliminated in the same way.

Layout of the duplicate portable plant on the two ends of the service trestle was such that the different units would coordinate without hindrance. Each gantry was on a tower high enough in clearance to permit a crawler-mounted crane to run under it. With a capacity of 10 to 15 tons at easy range the gantries handled most of the operations. The crawler-mounted crance served as auxiliaries in such manner that the gantries had to do very little traveling. Since the light cranes could boom down and move right under the gantries, they could get any place on the part of the trestle on which they were located.

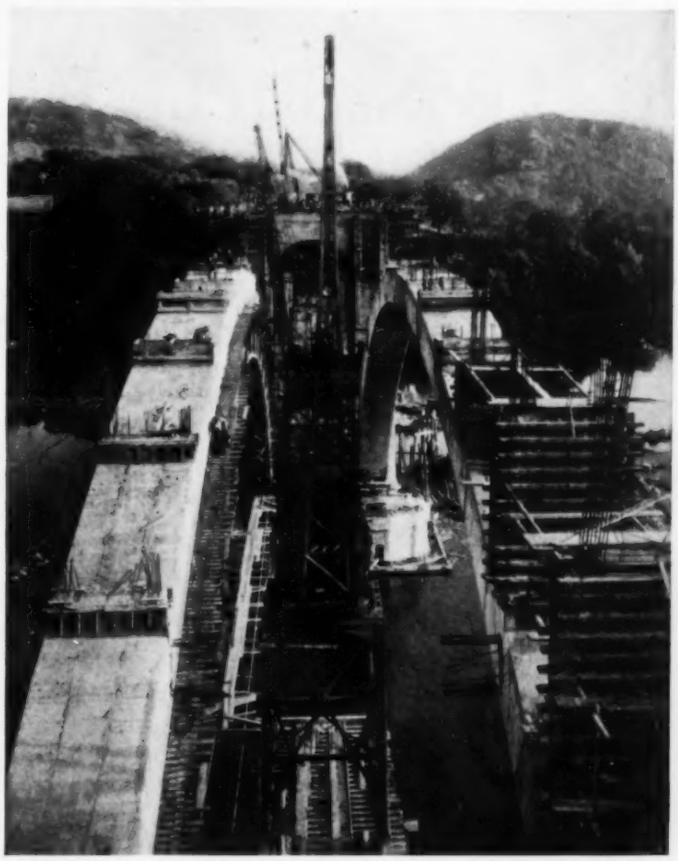
Concrete was delivered from the plant of the Ready-Mixed Concrete Co., of Knoxville, by the agitator-body motor trucks with a maximum haul of about 3½ mi. to the farther end of the bridge. At that end the trucks could not get down to the service trestle level, so they dumped their loads through a chute into a hopper from which bottom-dump buckets handled on flat cars were charged. These buckets were shifted out within the range of the gantry at that end by a light locomotive running on rails on the center line of the trestle.

At the other end of the bridge the trucks could be run down to the trestle and then out on it to gantry. The latter had range enough to dump the buckets at the highest point in the forms. Only one section of two of the ribs had to be placed by chutes to reach beyond the range of the gantry. The latter also was used to pour all of the columns on the arch ribs.

As soon as pouring could be started on the deck, a 100-ft.-boom portable stiff-leg steel derrick was set up at each end of the structure at the level of the roadway on the bridge. These derricks moved forward as the work progressed. They handled the forms for the entire deck. They also shifted the concrete for the deck in buckets from the agitator trucks to place. On some of the railing work it was possible to pour the forms directly from the trucks.

After placing 35,000 yd. of ready-mixed concrete in the structure the contractor's organization was convinced that this method was preferable on this job to two mixing plants that would otherwise have been required. No difficulty was experienced in getting whatever amount of concrete was needed at any time. The requirements of the job varied from nothing for a few days to the capacity of the producer's plant, but there was never any delay in pouring. Nor was it necessary to lose any concrete on account of delay in delivery due to street traffic or other causes.

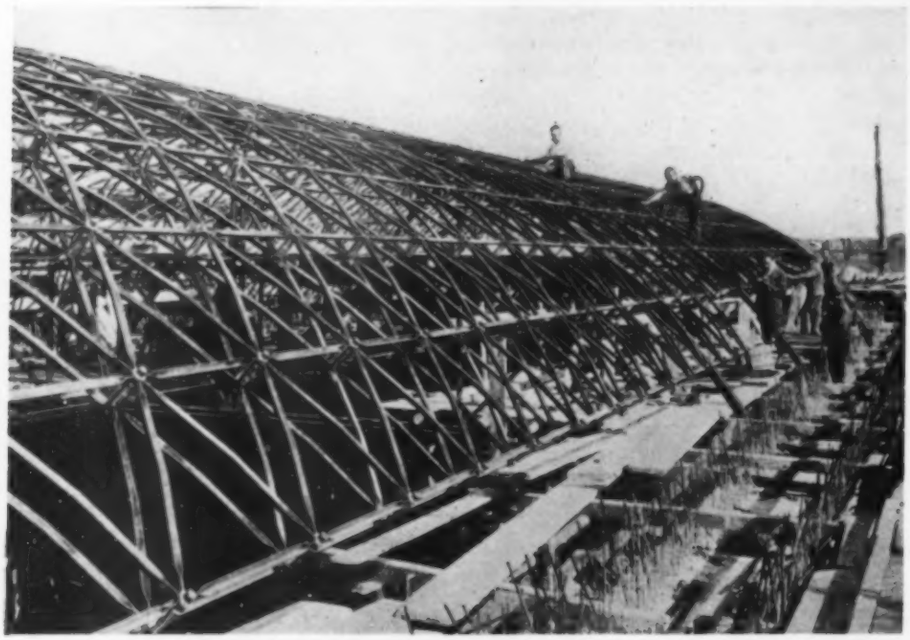
Plans for the Henley St. Bridge were furnished by the Marsh Engineering Co., of Des Moines, Iowa.



ERECTING *(right)* steel centering for 297 - ft. concrete arch rib of channel span with two gantries. Tie - backs with cables over adjacent piers avoided any obstruction of the 100-ft. open river channel.

L. M. Dow acted as supervising engineer for Knoxville and Knox County, with S. B. Godsey as resident engineer.

The organization in charge of this work for the Booth & Flinn Co., of Pittsburgh, included: A. R. Flinn, president; George Hockensmith, vice-president and general superintendent; Norman McLeod, superintendent; M. W. Murphy, assistant superintendent; C. F. Howison, resident engineer; and D. J. Leitch, office manager.



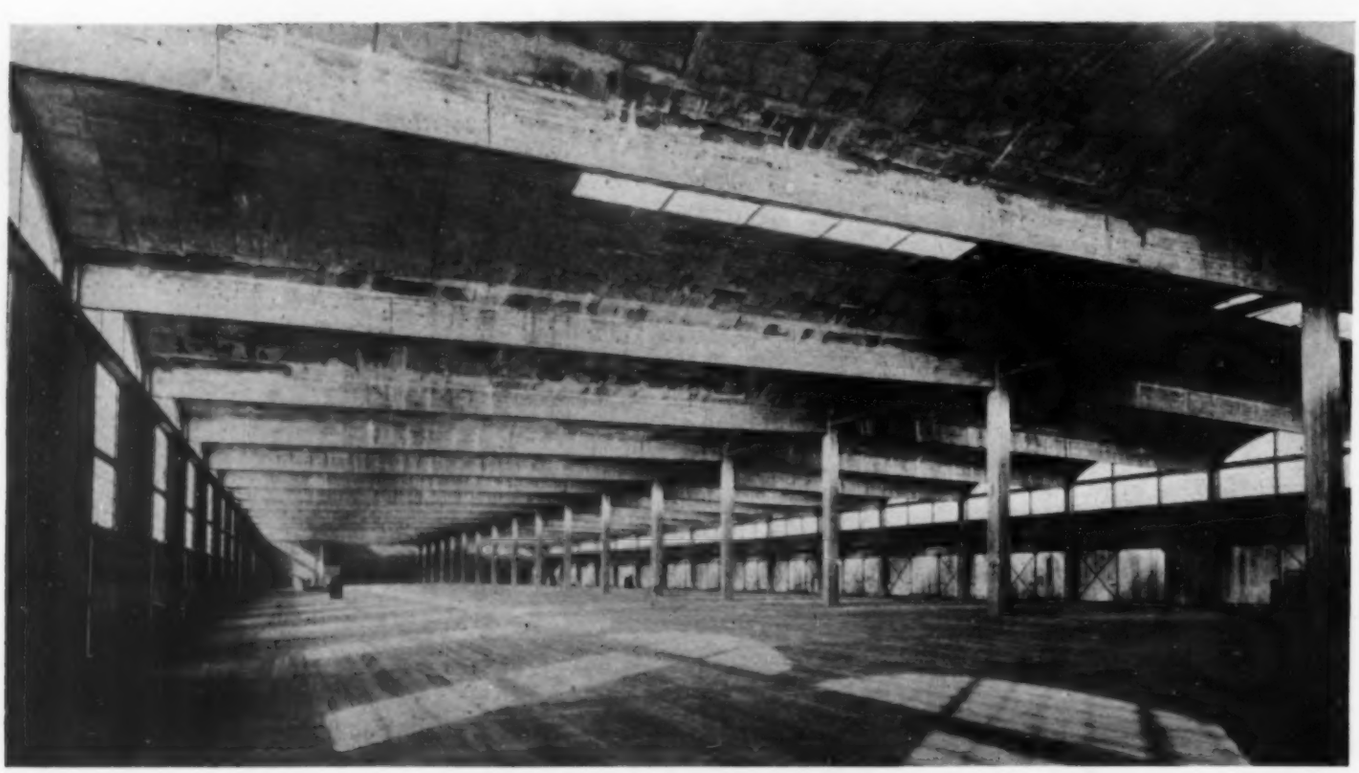
STEEL SPIDERWEB of current design for "barrel" shell is bolted into double system of triangular mesh to serve only as centering for form panels. After concrete is poured, steel network is removed and used again.

THIN SHELL ROOFS

of Concrete Dome or Multiple Vault Types, Following German Design, Provide Floor Areas Unobstructed by Columns

UTILIZING reinforced concrete in the form of comparatively thin, lightweight "shell domes" or "barrel shells," a design of German origin, introduced in this country by the Roberts & Schaefer Co., engineers and contractors of Chicago, makes possible the roofing of extensive areas of floor space without the introduction of obstructing intermediate columns. This type of roof, known as the Zeiss-Dywidac system, is applicable to a variety of structures, such as airport hangars, factory buildings, garages, market halls, theatres, pier sheds, armories, train sheds and gymnasiums, where a large expanse of unobstructed floor area is desirable.

Shell structures are essentially arched plates of reinforced concrete supported by stiffened rims and include two general types: (1) Those curved in two directions, called domes; and (2) those curved in one direction only, called vaults. The simplest type of dome is a hemisphere, while the fundamental shape of shell vaults is the semi-cylinder having a rectangular plan. By combining intersecting domes and series of vaults polygonal and irregular areas can be covered. Shell domes, when suitably arched, support the imposed loads with a minimum or even no bending moment in the shell and a uniform distribution of tension and compression across the depth of any section. Only direct stresses occur, so that the shell thickness is dependent upon the buckling effects of the loads



MULTIPLE VAULTS, with 30-ft. spans, form shell roof over pier shed 1,090 ft. long at Hamburg, Germany. Thickness of concrete roof shell is 2 3/16 in.

only, thereby making possible extremely thin shells.

Shell vaults, the designers explain, are a development of spherical shell domes, being suitably arched plates stiffened at intervals by rigid webs and having edge beams to transfer shear to the supporting columns.

Shell domes that are square or polygonal in plan may be made up by the intersection of two or more shell vaults. In such structures the ridges made by the intersecting shells serve as stiffening elements. The stiffening effect of these ridges produces a beam action, making it possible to support the dome on widely spaced columns. For this reason it is pointed out that polygonal shell domes are superior to hemispherical domes or other domes of revolution.

The dome type of construction found its first practical application in the roof of a planetarium built at Jena, Germany, by the well-known optical manufacturing firm of Zeiss and illustrated in two of the accompanying photographs. Shell domes to span 500 ft. and barrel shells to cover 170x200-ft. areas without the use of intermediate columns can be constructed.

As originally designed, a network of steel members, bolted together to produce a "spiderweb" of triangular mesh served both as centering for setting concrete forms and as the principal reinforcement for the concrete shell in which the network steel was embedded. This was the method of construction followed in building the Zeiss planetarium where the steel centering and reinforcing network was erected with the aid of a revolving wooden scaffold under the dome. From this scaffold the wooden form panels were hung to the network bars.

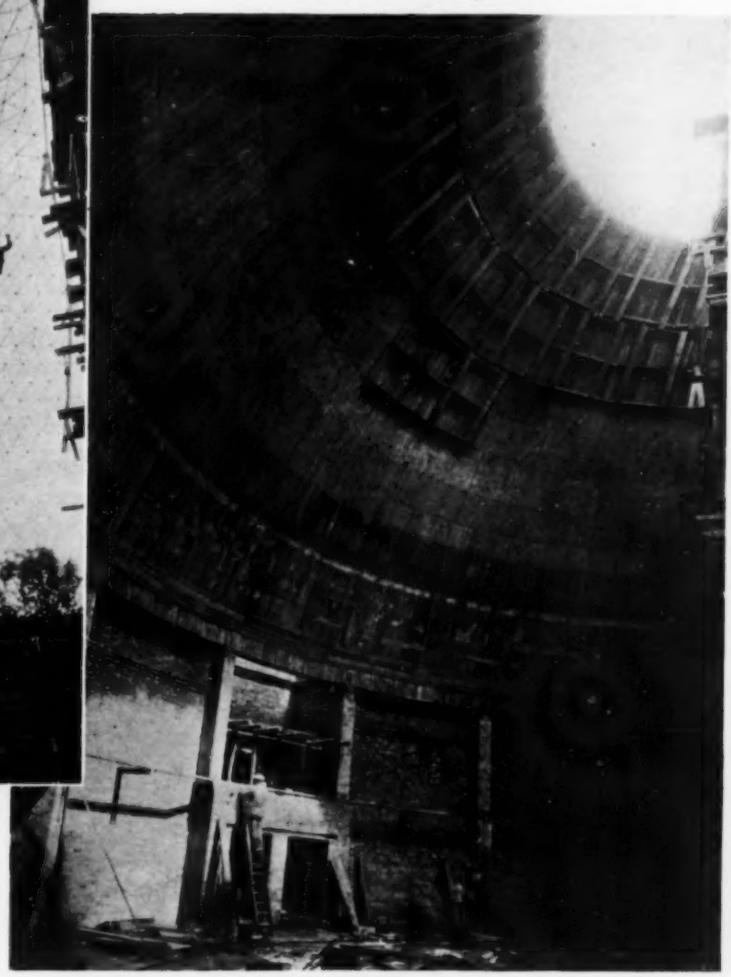
NETWORK *(above)* for dome roof over planetarium at Jena, following earlier practice, serves both as centering and as principal reinforcement embedded in concrete.

The latest method of shell construction, however, as illustrated by the semi-cylindrical vault type of work at the top of the preceding page, employs a double system of steel network serving only as centering to support form plates of steel or fibreboard for concreting. In this case separate reinforcement is placed, and after the concrete has been poured in the thin shell, the network centering system is unbolted, removed and used again. It does not remain embedded in the shell. This change from the earlier method, according to the designers of the system, has been made because it has been found cheaper and more desirable to use the "spiderweb" only as centering for the form plates and to support the steel bar reinforcement for the concrete shell, allowing both centering and forms to be reused for future jobs.

In the case of a pier shed at Hamburg, illustrated in the picture at the bottom of the opposite page, and involving a series of barrel shell roofs, the steel network centering was reused many times. This structure is 1,090 ft. long and 164 ft. wide and consists of a double line of 36 barrel shells, each with a span of 30 ft. and a thickness of only $2\frac{3}{16}$ in.

Shell roofs also are adaptable to cantilever construction, of which an example is offered by a train shed at Munich. Here cantilevered roofs 2 in. thick and from 23 to 35 ft. wide are carried by a row of central columns spaced on 30-ft. centers.

FORM PANELS *(below)* for dome roof of Jena planetarium are hung from steel network centering with aid of revolving scaffold.



BRICK WHITEWASHED

to Aid Removal of Excess Asphalt Joint Filler

FIRST BRICK of new wearing surface is laid by Commissioner J. H. Anderson.

A COAT of whitewash carefully applied by hand to the tops of brick laid on the Washington St. Memorial Bridge over Brandywine Creek, Wilmington, Del., prior to filling the joints, facilitated the removal of excess asphalt and resulted in a clean surface presenting minimum skidding hazard. By scratching guide lines on the rolled sand-tar cushion before laying the brick, the paving crew was able to keep the joints in perfect alignment even when constructing a herringbone pattern.

The bridge roadway is 720 ft. long and 40 ft. wide, with a double line of trolley tracks through the center flanked on both sides by 12-ft. driveways. Rails of the trolley tracks were laid to conform with the roadway crown of 4 in.

After removing the old surface, the paving gang leveled the concrete base by screeding grout over existing low spots. Acting on the advice of the National Paving Brick Association, a tar-asphalt cushion was screeded on the concrete base to a thickness of $\frac{3}{4}$ in. and was compacted with a hand roller to a firm bed not less than $\frac{1}{2}$ in. thick.

Guide Marks—Between the two trolley tracks, the bricks were laid parallel with the rails; between the rails of each track, they were placed in transverse direction. On the 12-ft. traffic lanes, the engineers varied the pattern by laying the brick herringbone style. Only one shape of special-cut brick was used along the edges of the herringbone pattern, two rows of

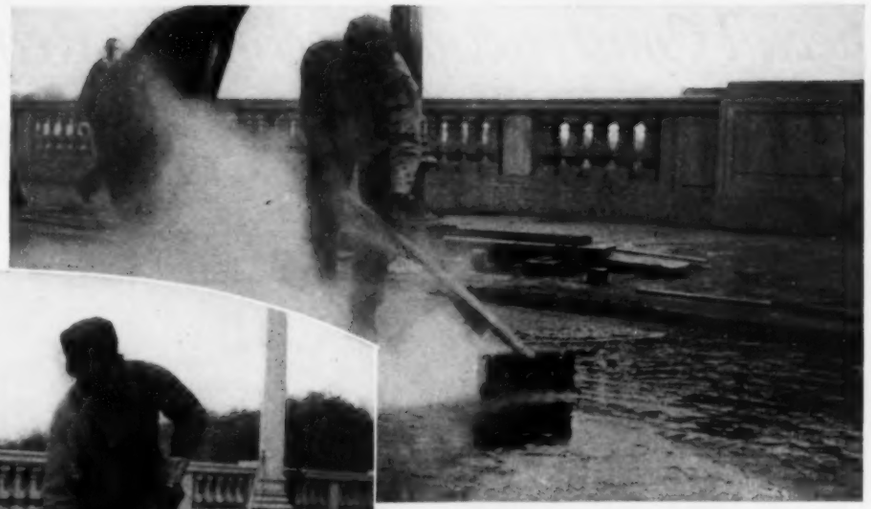
SCRATCH TEMPLET, with accurately spaced nails along bottom, marks guide lines in sand-mastic cushion to indicate correct alignment of longitudinal joints in brick course.

HERRINGBONE PATTERN is laid on 12-ft. traffic lanes. Guide marks aid in keeping joints in line.

WHITEWASH COAT *(left)* is applied painstakingly to exposed brick surfaces, care being taken that no lime gets into joints.

HOT ASPHALT *(right)* spread on surface is worked into joints with squeegees. After first application has settled in joints, second coat is applied to fill joints completely.

SCRAPERS *(below)* remove rolls of surface asphalt from whitewashed brick. Removal starts about 15 min. after second asphalt application.



brick first being placed parallel with the outside rail and four rows parallel with the curb, to form a gutter.

To provide straight, parallel lines for the guidance of the bricklayers, a scratch templet having nails accurately spaced along the bottom was drawn over the cushion after the final rolling. The scratch marks enabled the bricklayers to keep the longitudinal joints in alignment. Bricks were laid and tamped to firm bearing by hand, long planks being used to distribute the tamping uniformly. The suface then was rolled to bed the brick solidly on the cushion.

Whitewashing Surface — After a portion of the brick surface had been laid, workmen applied a coat of ordinary lime whitewash to the exposed surfaces of the brick with hand brushes, care being taken that none of the lime entered the joints. This careful whitewashing required much time, but it was necessary because the filler would not adhere to the brick if lime got into the joints.

Asphalt meeting the requirements of the National Paving Brick Association was heated to a temperature of at least 360 deg. F., and was poured over the surface and worked into the joints with squeegees. After the first asphalt coat had set, a second application was made to complete filling of joints in which the filler had settled.

Removing Excess Asphalt — In about 15 min., the asphalt could readily be scraped in sheets from the surface of the brick. Whitewash remaining on the surface was soon cleaned off by rain or by traffic. Work of removing the surface asphalt was most easily accomplished if started about 15 min. after the application of the second coat. After a day of cool winter weather the asphalt became hard and brittle, chipping off in small pieces and adding to the labor of removal.

Asphalt scraped from the surface was found to contain less than 0.1 per cent lime. To avoid building up the lime content to an extent that would affect the ductility of the asphalt, the proportion of waste asphalt used in making new filler was limited to 50 per cent, an equal proportion of fresh asphalt being combined with it.

Results and Cost—Test bricks were selected at random and dug up. In every case, the asphalt was found to adhere tenaciously to the brick and to fill the joint completely. Alban P. Shaw, county engineer of New Castle County, who had charge of the project, estimated the cost of painting the brick and removing the excess asphalt at about 6c. per square yard. Some saving was made in salvage of asphalt and in ease of applying filler.

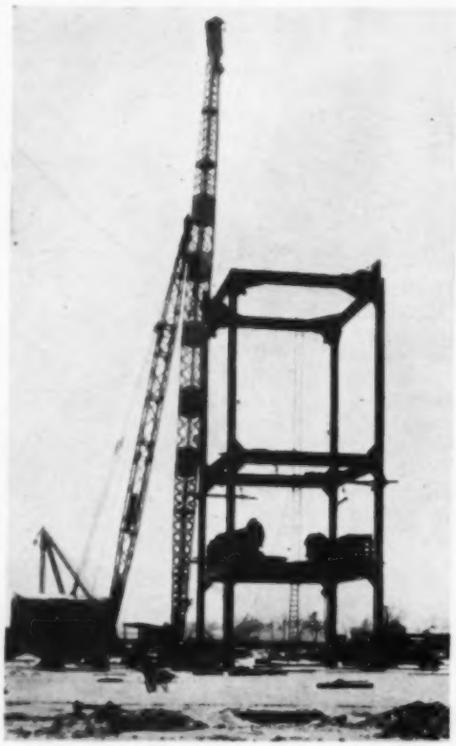
REMAINING WHITEWASH *(below and right)* soon is cleaned off by rain and traffic, exposing slightly-glazed brick surface which does not stain with oil droppings. Note full joints at right.

Special Construction Technique Required in Building

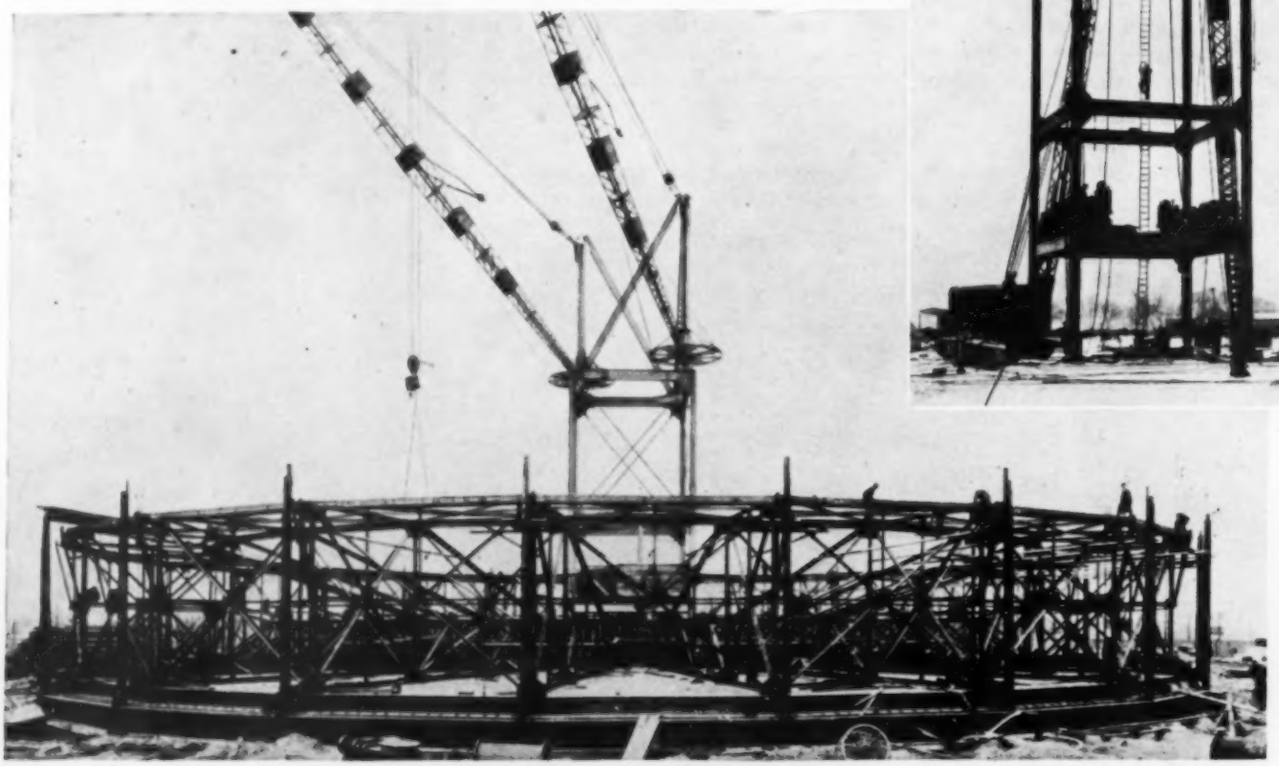
WATERLESS GAS-HOLDERS

IN building waterless gas-holders to provide reserve storage in distribution systems for meeting peak load demands, the Bartlett-Hayward Co., of Baltimore, Md., as a result of its experience in installing a large number of these structures throughout the country, has developed a special construction technique illustrated, in its main features, in the accompanying series of photographs. Of relatively new design, the waterless holder, differing radically from the earlier telescopic water type of pressure tank, is a hollow structure of polygonic cross-section, having from 10 to 20 sides constructed of riveted steel sheets, doubly flanged for stiffness, and built-up steel columns at the corners. It has been built in capacities from 500,000 to 20,000,000 cu.ft., diameters ranging from 82 to 285 ft. and heights from 115 to 425 ft.

The structure has a gas-tight bottom of riveted steel plates on a concrete base and a roof which protects it from the weather and also provides structural rigidity. Within the prism of the holder is a trussed steel piston which "floats" on the gas and is free to move up or down as gas is admitted or withdrawn. A special detail of this type of holder is the gas-tight seal between the movable piston and the walls of the steel shell. Around the perimeter of the piston is an annular cup, filled with tar, which makes contact with the sides of the holder through the medium of a strip of canvas and flexible steel "rubbing" bars held in place against the inside of the shell by weighted lever arms. Among

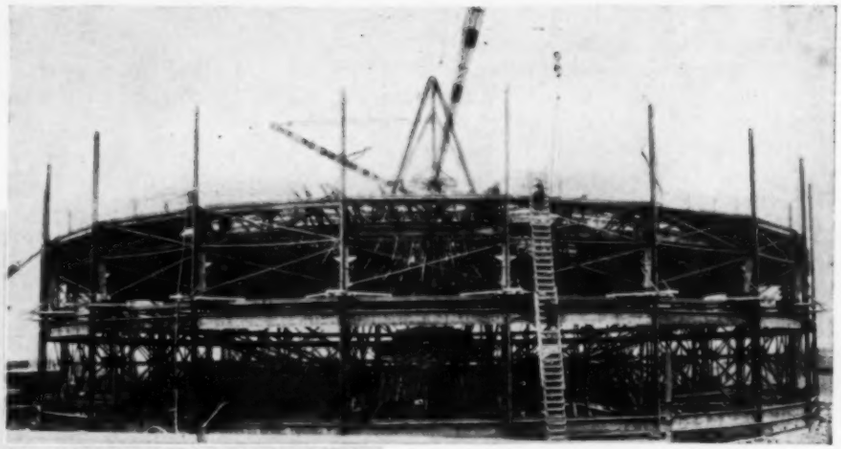


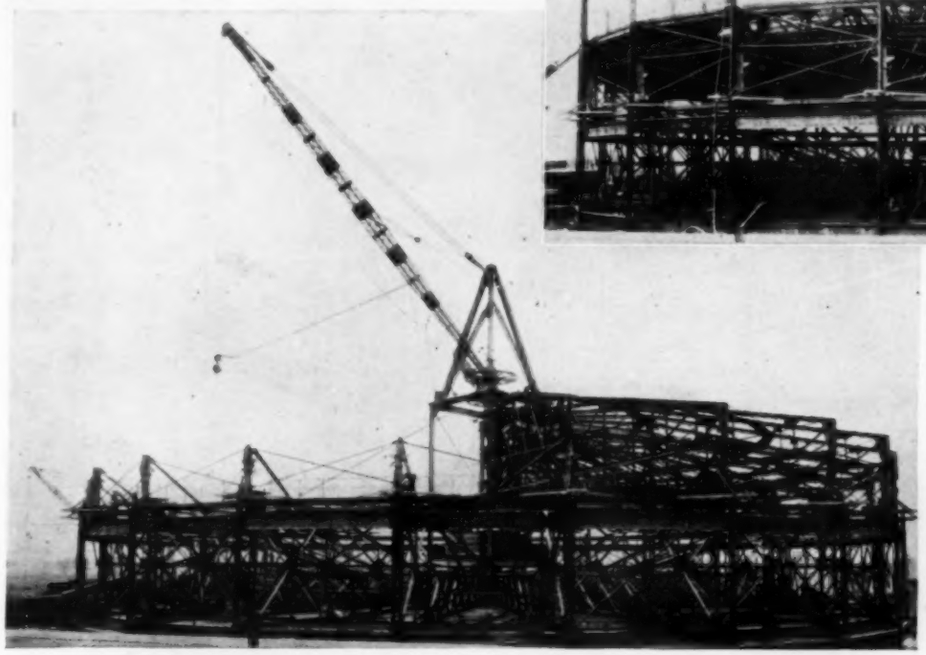
FOR STEEL ERECTION ***(left and below)*** **a pair of stiff-leg derricks is elevated upon steel columns at the center of foundation.**



STEEL PISTON TRUSSES are set by the derricks upon the bottom of the gas-holder and corner columns are erected to height of 32 ft.

UPON COMPLETED PISTON *(below)* roof trusses are set and columns are extended *(right)* by additional sections preparatory to placing and riveting the steel plating forming the sides of the structure.



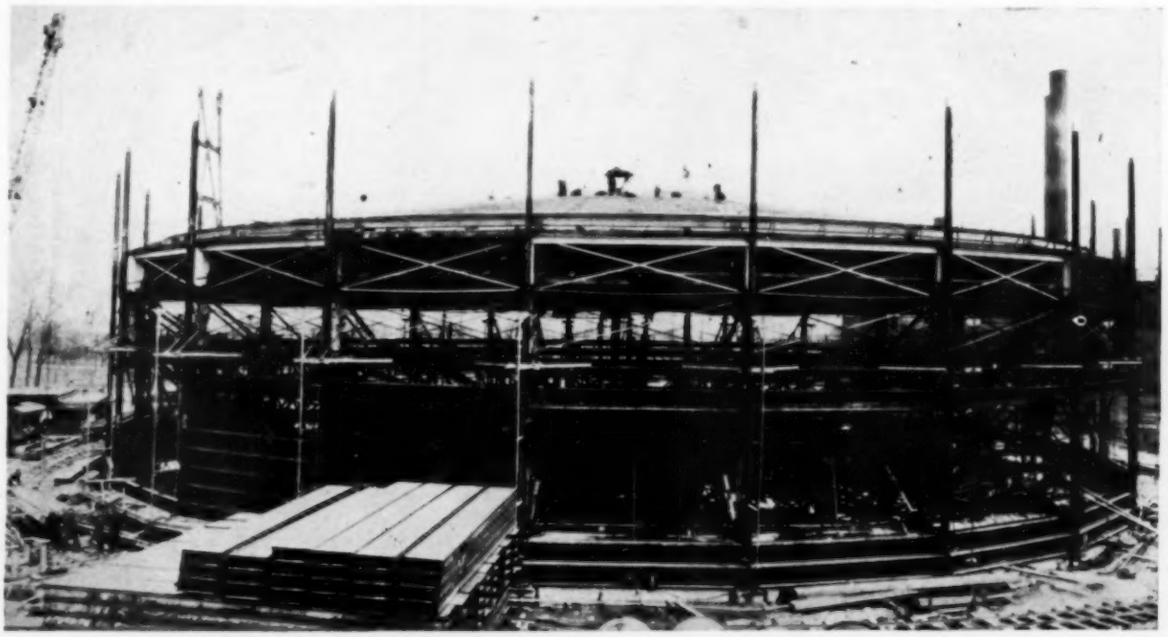


advantages claimed for the waterless gas-holder, as compared with holders of the telescopic type, are a great reduction in weight, with less foundation and piling, and a ground site of smaller area.

In building a waterless gas-holder, the first construction operation consists of driving piling, if necessary, and placing a 6-in. foundation pad of concrete, piers carrying anchor bolts to support each column and a concrete wall around the outer edge of the structure. While this work is in progress, construction plant is being prepared for the erection of the steel. The sequence of field operations then continues with the riveting of the steel-plate bottom and lowering it to position on the concrete pad, the erection of the corner posts or steel columns to a height of 32 ft., the assembly of the piston and the building of the roof structure on top of the piston. These operations are all completed from ground level, after which the steel plates forming the shell of the holder are started. As the sides are built up, air pressure is introduced to raise the piston and the roof on top of it and carry them upward as the shell construction proceeds.

Steel plates for the gas-tight bottom of the holder, usually about $\frac{3}{16}$ in. thick, are assembled and riveted on troughs 30 in. high above the concrete foundation pad. The delicate operation of lowering to place, without buckling, this expanse of steel (from about 7,000 to 61,000 sq.ft., depending on the size of the holder) is then accomplished by means of screw jacks, turned down at a uniform rate.

With the bottom seated on its foundation the work of steel erection proceeds with the aid of a pair of stiff-leg derricks elevated on column supports at the center of the structure. (An



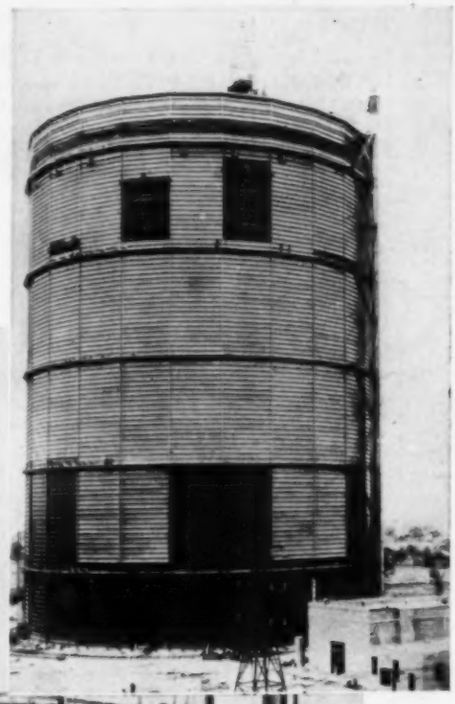
STEEL PLATES, with top and bottom edges bent for stiffening, are bolted to each other and to the columns to form the sides of the holder.

alternative method involves the substitution of a trammel derrick, operating on a circular track, for the elevated stiff-leg derricks.) Corner columns are set and to them the lower rung of shell sheets (previously riveted to the bottom, before lowering) are connected to the columns. Then the piston trusses, assembled and riveted, are picked up and set in place and the piston plating and bracing are riveted. Rollers are installed to guide the piston in its travel up or down the columns of the holder.

Directly on top of the piston the roof trusses with their plating and bracing are next erected.

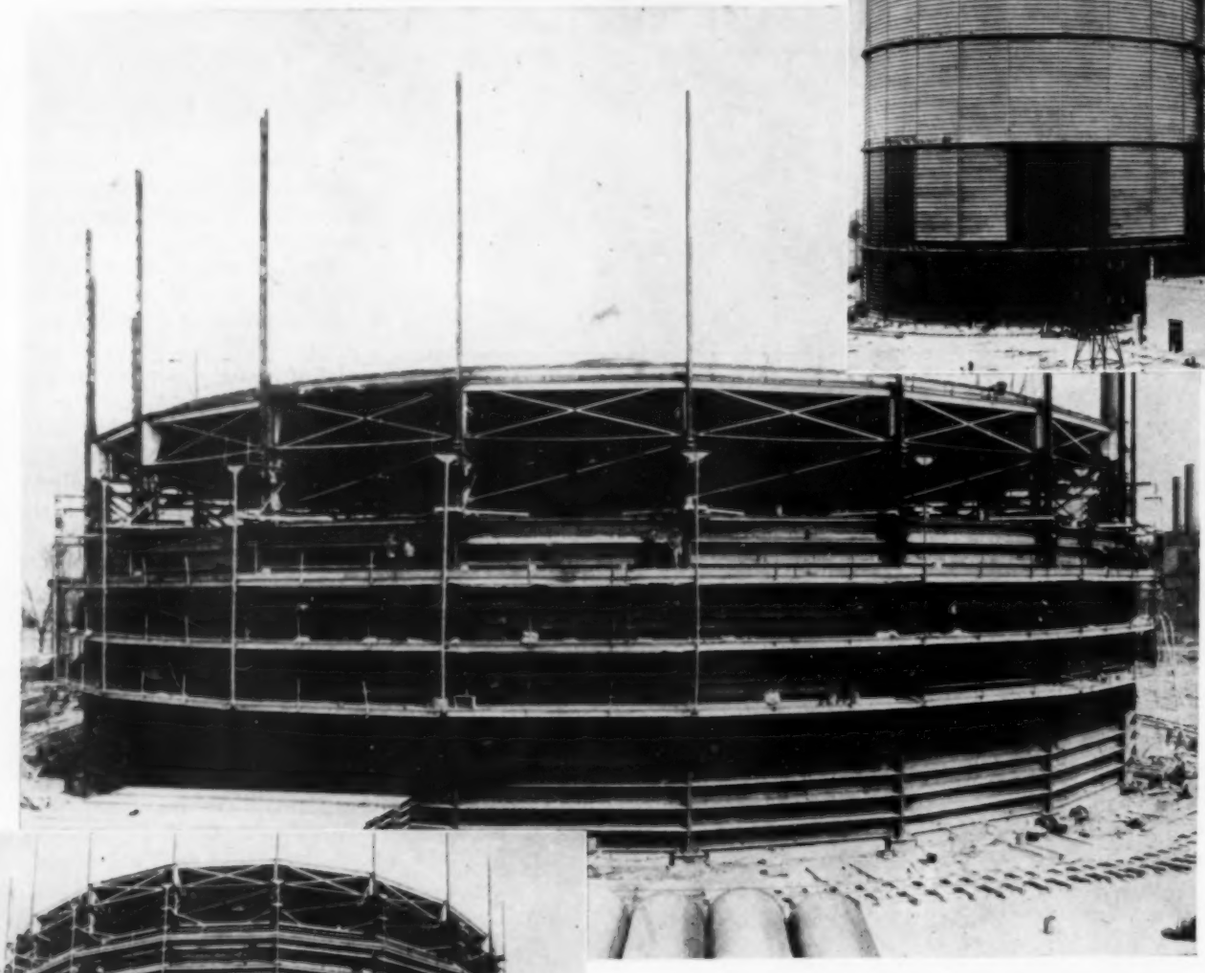
For placing and riveting the steel side plates forming the shell of the holder a 3-stage scaffold is hung on the outside of the structure. The center erection derricks are removed and two light shear-leg derricks running on a circular track, are placed on the roof. After seven courses of shell plates (each 32½ in. high) are erected and riveted, air is blown into the partially completed holder, raising the piston, the roof on top of it and the erection scaffold a distance equal to one shell course. The next shell course is then riveted and the piston again raised, by air pressure, the height of another shell course, the operation being repeated until the side plating is carried up to the top of the structure. As successive shell courses are riveted the columns at the corners of the holder are extended by additional sections. Under normal conditions five or six rings of shell plating are completed daily.

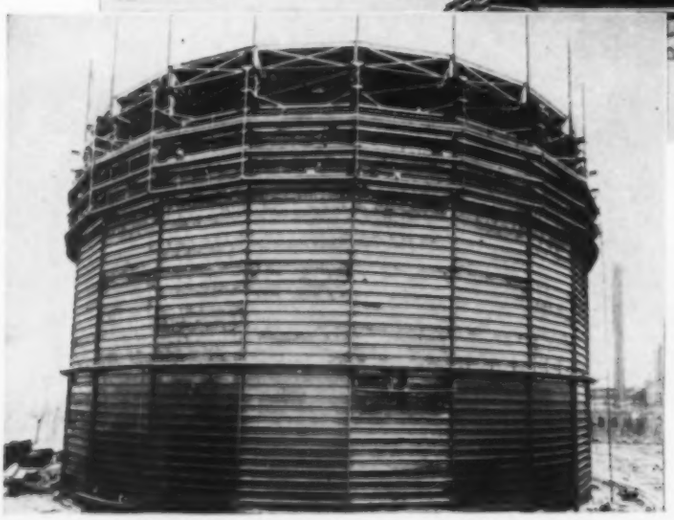
When the top is reached the roof is set in place and the piston cut loose from it and lowered by removing air from the holder. The tar cup sealing device is then installed and after purging the interior of the shell of air used during construction, the holder is filled with gas and placed in service.



COMPLETED GAS-HOLDER *(right)* **of waterless type showing steel sheathed structure of polygonic cross-section.**

THREE - STAGE SCAFFOLD *(below)* **for erecting shell plates is hung from piston and roof trusses which are raised, one course at a time, by blowing air into partially completed holder.**

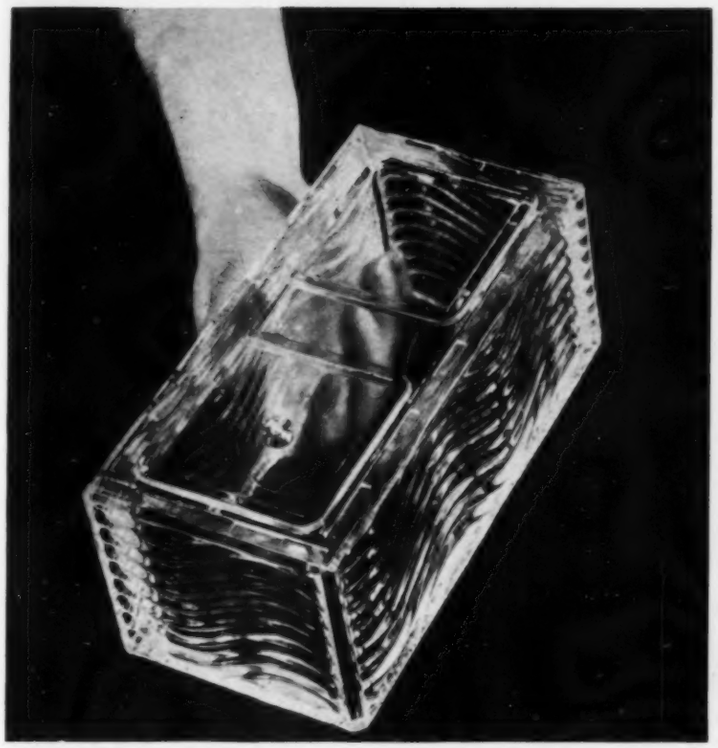




NEARING TOP. Piston has been "blown" upward, carrying with it the roof truss and the three - stage plate erection scaffold.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction



HOLLOW GLASS BRICK for non-weight-bearing walls and decorative panels offers new possibilities in building field. Prismatic ridges increase light-gathering qualites, but make brick non-transparent. Measurements, 8¼x3¼x4¼ in.; wall thickness, ¼ in.; weight, 3 lb. 9½ oz. Brick is laid with open end down, using 1:1½ cement-sand mortar. Groove in top insures bond between courses. Air space between sides acts as insulator. Brick is made by Corning Glass Works of fire-resistant Pyrex glass, annealed. Crushing strength, 4,700 lb. per square inch. Shipped in corrugated pasteboard containers.

Is there an ODDITY *on your job that should be illustrated on this page?*

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CARVING NAMES WITH AIR. Pneumatic sand-blast equipment facilitates task of inscribing names of soldier dead on stone wall roster of Canadian War Memorial at Vimy Ridge, France.

A COLD PLUNGE *(below)* doesn't seem to bother this P & H dragline as it crosses the ice-covered Gunnison River under its own power at Grand Junction, Colo., to start moving earth for the Claybough & Page Corp.

HOUSE AHOY! Wooden structure in path of approach for new Washington memorial bridge at Seattle, Wash., is loaded on barges and shipped to new site.

ARC-WELDED STEEL PANELS *(right)* being erected on first floor of Anthony residence.

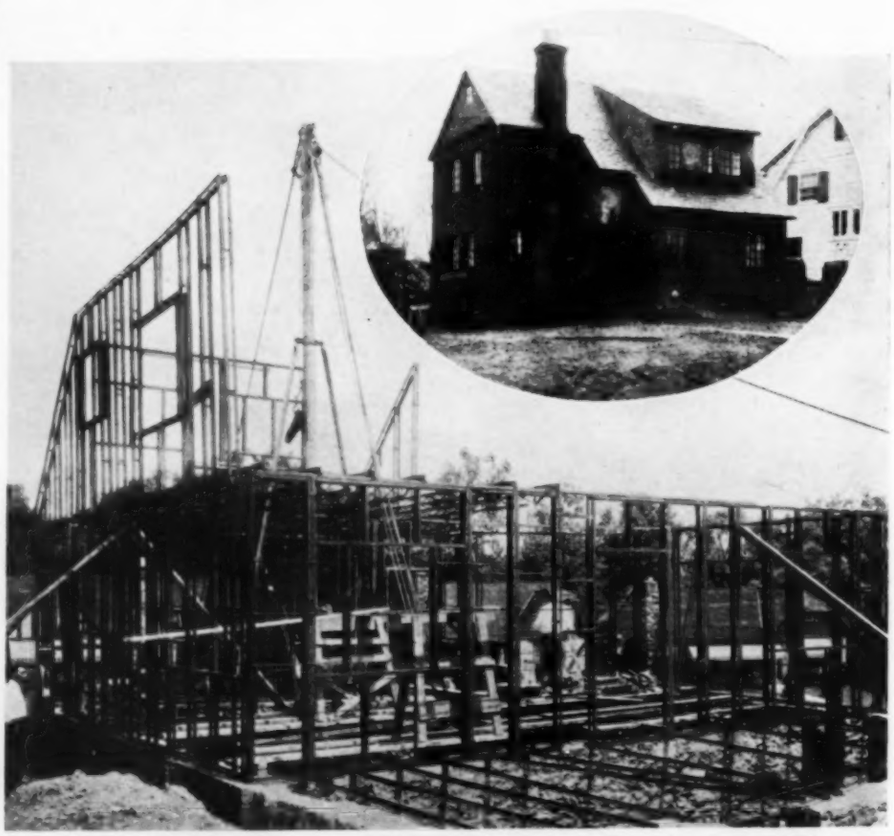
FRAME PANEL *(below)* is being welded to the 6 x ¼-in. steel sill plate.

Six-Room Brick and Steel House Completely ARC-WELDED

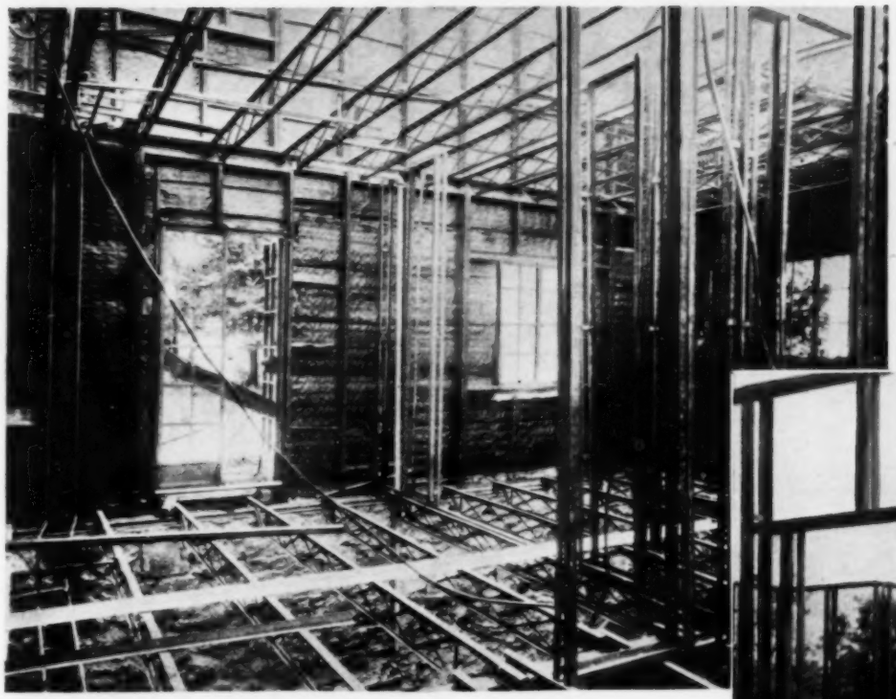
AN example of a completely welded steel frame and brick dwelling is furnished by the house recently completed for C. E. Anthony at Larchmont Gardens, N. Y. It is a six-room, two-story building 32x26 ft., with full basement and two-car basement garage.

The entire framework and all interior partitions are made up of standard size panel frames previously fabricated in the welding shop from 1½-in. angles. They consist of two duplicate frames tied together with spacers to provide the regular wall thickness of 4 in. throughout the house. Two sizes are used. The wall sections in which there are no windows are 2x9 ft. The window sections are 6x9 ft., of sufficient size to accommodate any window normally used in a dwelling house.

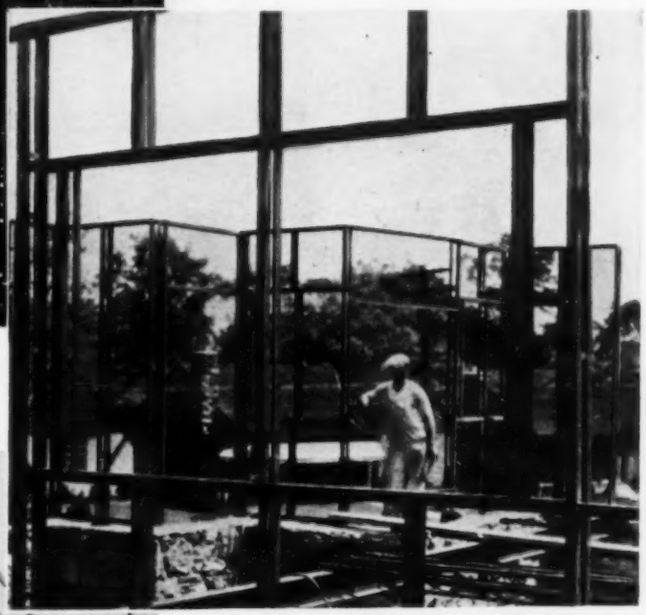
In erecting the walls and partitions a plate sill 6 in. wide by ¼ in. thick was laid directly on the masonry foundation and fastened down by means of



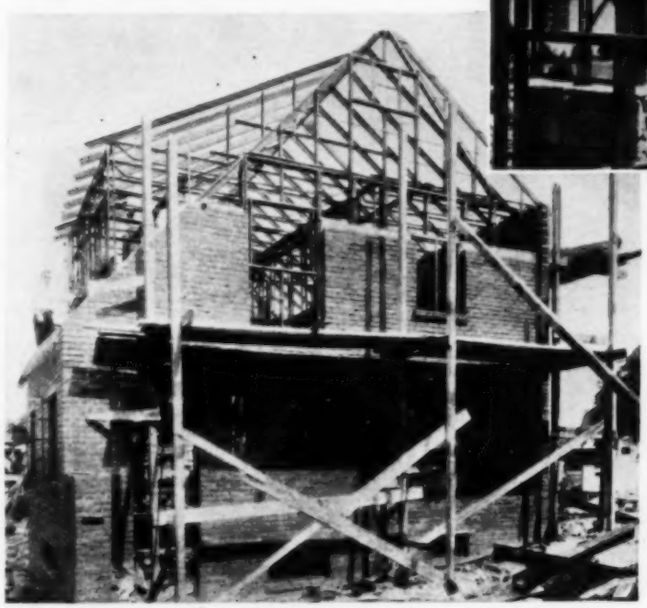
FIRST-STORY FRAME COMPLETED, with one side of second story panels in place. HOUSE *(in insert)* is two-story six-room structure, 32 x 26 ft. in plan.



INTERIOR CONSTRUCTION, showing floor joists, partition panels and wire-mesh backing of brick veneer.



DETAIL of one-piece double window panel on first floor.



BRICK VENEER *(right)* partly completed. Rafters are 4 - in. channels spaced on 2-ft. centers and welded to outside wall framework.

bolts grouted in the concrete. The fabricated panels were then welded to the sill. Adjoining panels were welded together at their edge to make a solid structure throughout. The second floor was erected in exactly the same manner and was welded to the top of the first floor sections. Electric current for all field welding was generated by a General Electric gasoline engine-driven arc-welding set.

An 8-in. I-beam was used for the main floor bearing beam. All floor joists, on both the first and second floors, are of steel truss construction, 8 in. deep, and welded to the frame of the house at each end and to the bearing beam or partitions in the middle. This type of floor beam was used to provide rigidity without excess material. Steeltex, a 2-in. wire mesh, spot-welded at each juncture and backed with fire-resisting, waterproof paper, was laid directly over the floor joists and covered with a 2-in. course of concrete to form the floor.

The roof supports or rafters are 4-in. channels with 2-ft. spacing and were welded directly into the outside wall framework of the building. The gable sections were fabricated in the shop, trucked to the building site, hoisted into place and welded to the framework proper. The roof covering consists of Steeltex placed directly over the rafters and covered with a 2-in. layer of Nailcrete, a concrete-asbestos composition into which nails can be driven for fastening the shingles. A layer of slate shingles was used.

The outside of the house is finished off with a brick veneer inside which is placed a layer of paper-backed wire mesh. The gables and dormer are finished with stucco. All windows are of the steel casement type welded into the framework of the building. All doors are of Kalman steel construction, set in steel bucks and frames welded into place.

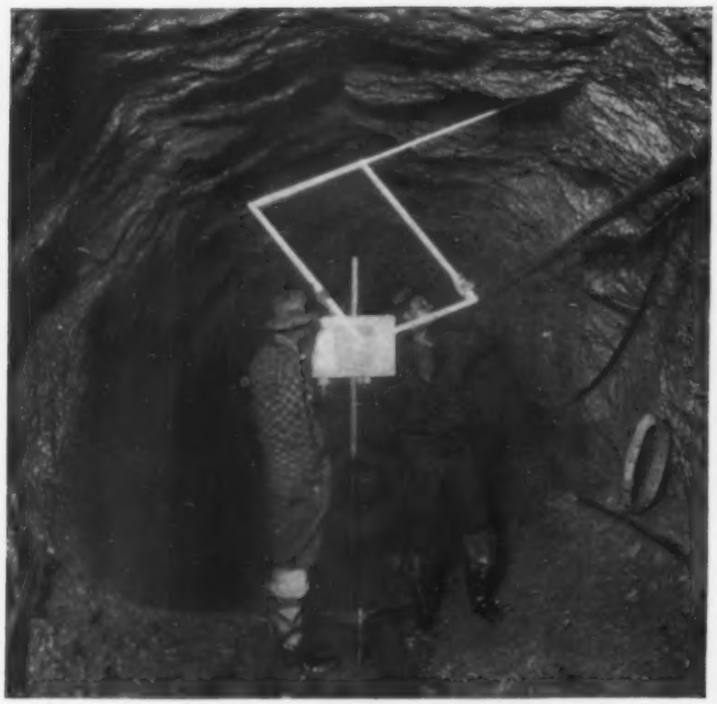
The interior finish of the house consists of wire mesh over the framework and hard plaster. In fastening the mesh, attachment bars consisting of small rolled steel channels with wire fasteners spot welded to it were used. The channels are securely tack welded to the steel framework and the mesh tied in place by means of the wires.

The floors are covered with Armstrong inlaid linoleum with a felt backing on both the first and second floors. The stairways are steel with ornamental iron railings, welded in place, and have Sutterlith treads, a composition of plaster of paris, cement and sawdust. All baseboards are also made of this material.

Many advantages are claimed for the welded type of construction, among them being the following: Rapidity and noiselessness of construction; use of standard panels; flexibility of design; fireproof construction, giving lower insurance rate; rigidity and solidity, eliminating vibration; low rate of depreciation; and soundproof walls.

Getting Down to DETAILS

Close-up Shots of Job Methods and Equipment

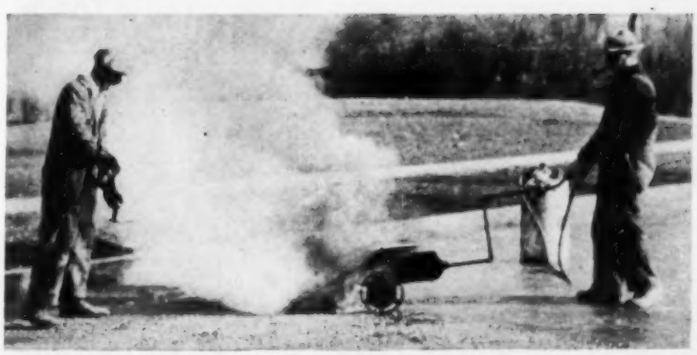


PANTOGRAPH designed and built on job reproduces graphically on 30:1 scale actual cross-sections of tunnel used in computing quantities for two rock tunnels of Cobble Mountain combined water-supply and hydro-electric development of Springfield, Mass. Cross-sections are taken every 25 ft. or more often, if necessary.

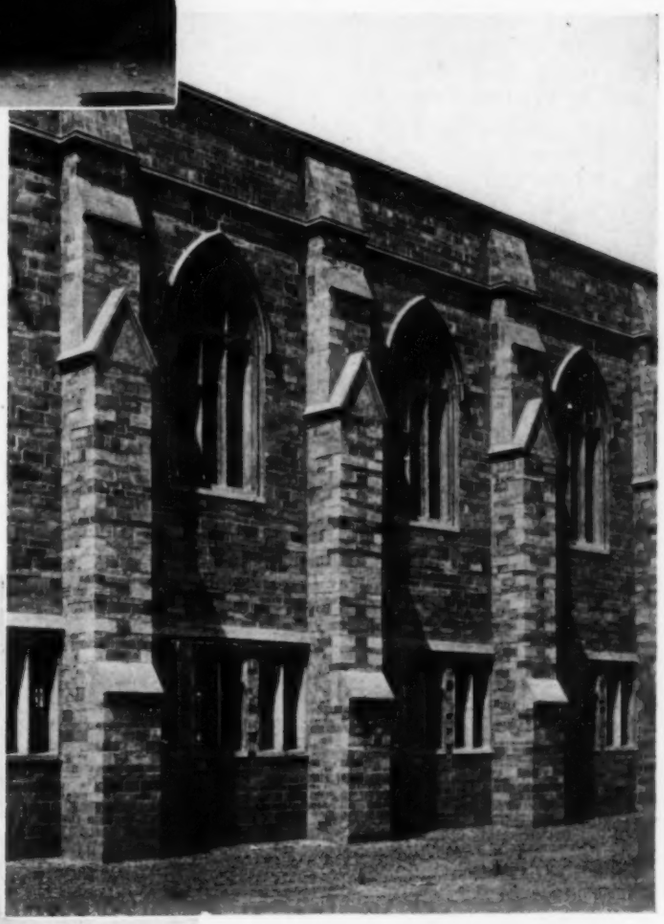
TO FILL JOINT IN CONCRETE PAVEMENT, Ohio Department of Highways first cleans joint with compressed-air jet from long-handled nozzle *(left)* and then seals joint with hot asphalt from manually-operated buggy *(right)*. After first application, settlement of asphalt occurs, and a second and final filling is required. Asphalt flows from pipe (attached to transverse arm) extending toward operator parallel with joint, thus facilitating task of keeping machine on true course. Flow of joint filler is controlled by lever on right handle.—*Photos from* EARL V. MURRAY, *statistician, Ohio Department of Highways.*

PERSISTENT SLIP *(left)* on highway in Hamilton County, Ohio, is stopped by driving two rows of 10-in. steel-pipe piles 30 ft. long, filling casings with concrete, and tying tops of piles together with reinforced - concrete beams. Piles extend below plane of slippage. Roadway, berms and slopes are restored, and slope is extended to concrete framework. Structure acts as unit in resisting further slippage. —*Photo from* WILLIAM C. HARTZ, *deputy county surveyor, Hamilton Co., Ohio.*

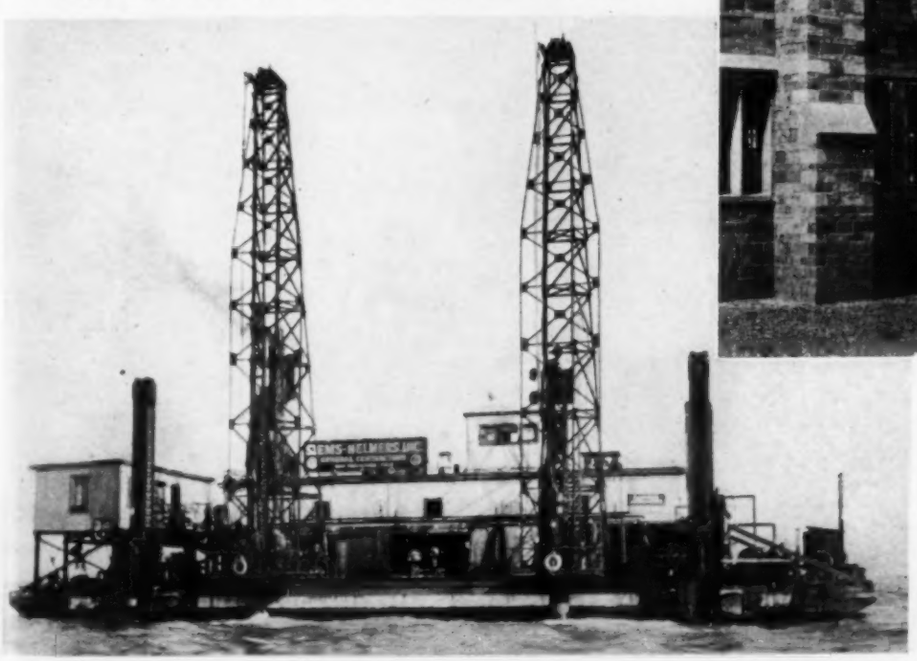
FOR TANDEM-PAVER OPERATION *(above)*, Rex 1932 model has swinging discharge chute *(left)* operated automatically by skip of second mixer. H-section connecting bar between pavers passes between blocks under skip. Flexible coupling permits machines to be steered independently.



OIL TORCH on wheels, with shield to deflect flame, heats slippery spots on bituminous macadam. Stone chips spread to prevent skidding.—*Photo from* WARREN W. PARKS, *Mariemont, Ohio.*



COLORED CONCRETE ASHLAR of pre-cast, textured blocks, forms walls of Berks County prison, Reading, Pa. Berks Building Block Co., of Reading, colored concrete masonry units in several shades from light buff to chocolate brown. Alfred Hopkins & Associates, architects; L. H. Focht & Son, Inc., of Reading, general contractor.



DRILL BARGE of Siems-Helmers, Inc., engaged in removing 40,000 yd. of rock to lower several rock clusters in San Francisco Bay from present depth of 35 ft. to 40 ft., is equipped with two Ingersoll-Rand submarine hammer drills and with four spuds and six anchors to resist severe tidal and weather conditions inside Golden Gate.

Concrete Pavement Cured With

DUPLEX PAPER

IN an unpublished departmental report Mark Morris, research assistant, Iowa Highway Commission, records results of studies of curing concrete by covering with heavy duplex paper to prevent loss of moisture. The accompanying photographs, illustrating the application of Sisalkraft paper to freshly concreted pavement slabs, are typical of the methods practised in this type of concrete curing. From one of the Highway Research Board's abstracts, Mr. Morris' findings are summarized as follows:

"This department, during 1931, investigated the use of two heavy duplex papers for curing pavements and concrete floors. Each consisted of two layers of heavy kraft paper sealed together with a thin coating of asphalt. To compete successfully on a cost basis with moist earth curing, these papers must be used probably 5 to 9 times. At each application of the paper, samples of it were tested in the laboratory to determine its ability to prevent loss of moisture from mortar cured, for the first 24 hr. after placing, under wet burlap.

"From previous work it has been found that satisfactory curing requires that the concrete retain at the age of 6 days at least 80 per cent of the original water content. These papers showed losses varying from 0.61 to 4.29 per cent, at the initial application of the paper, to 2.00 to 7.87 per cent for the paper in the condition as found after the last application. Concrete losing this small amount of water in 6 days may be considered to have received satisfactory curing. Properly handled, therefore, these duplex papers were found to provide a satisfactory means of curing for concrete pavements."

DUPLEX PAPER *(above)* in three 7-ft. strips covers 18-ft. Iowa concrete pavement, with laps weighted down by earth. Curing period, 7 days. TWO WIDTHS *(left)* of paper are sometimes glued together to form roll. EDGES *(below)* of pavement are covered by overlap of paper to prevent loss of moisture.

Step-by-Step Production Methods

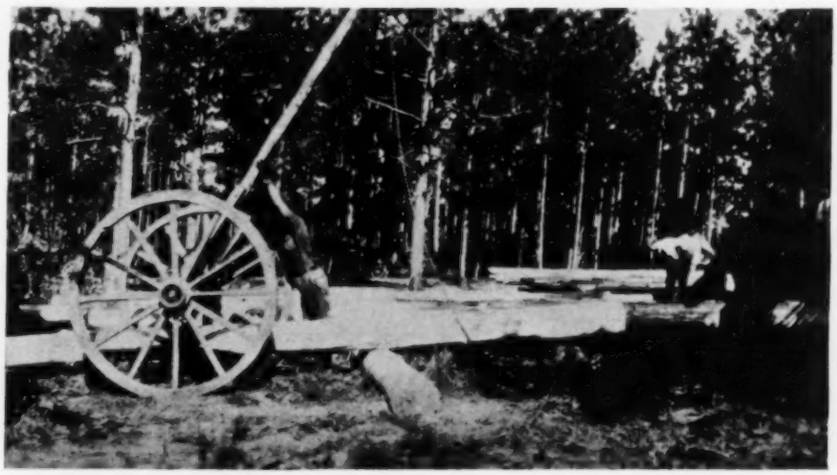
CREOSOTED POLES

STARTING with the felling of a pine tree in a Southern forest, the accompanying photographs illustrate, in sequence, the various operations involved in the production of creosoted poles for such construction uses as power transmission, telegraph or telephone lines, piling, trestles and bridges. As soon as a tree is cut, it becomes a prey of two destructive agencies, fungus spores and termites. It should, therefore, be shipped without delay to the treatment plant where, after seasoning, its sap is removed and replaced with creosote oil which acts as a poison to prevent attacks to which untreated timber is subject.

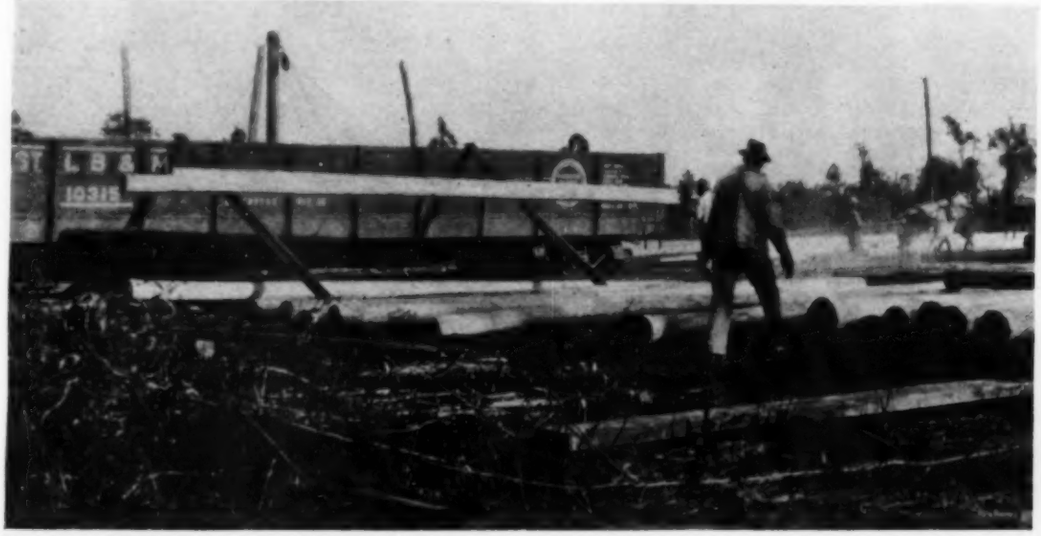
An example of the detailed procedure of producing creosoted poles is offered by the operations, pictured herewith, of the Texas Creosoting Co., with plants located at Orange and at Houston, Tex., in the heart of the yellow pine belt.

1 AFTER INSPECTION as to size and quality the trees selected as suitable for use as creosoted poles are blazed with hand axes. The sawing gang fells the marked trees.

2 A PEELING TOOL strips off the bark of the felled tree, after the top has been sawed off to produce a pole of the proper length.

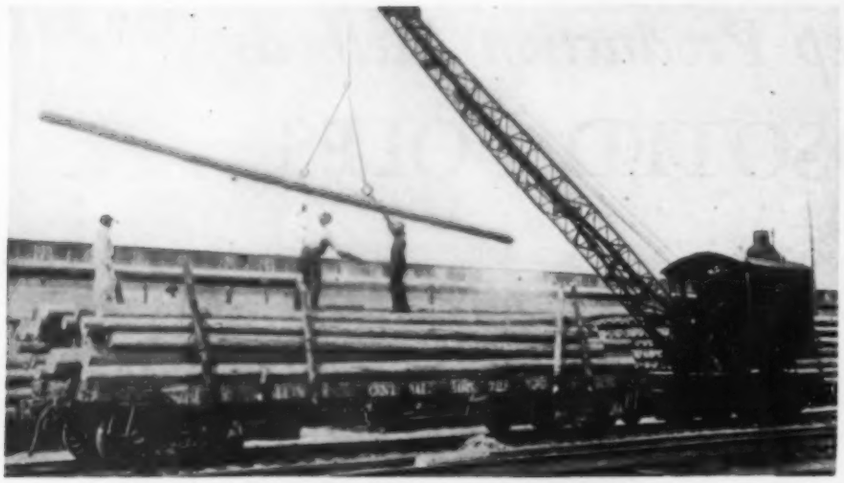


3 WITH A TWO-WHEELED CARRY-LOG the stripped pole is picked up in the woods, loaded on a truck and carried to a point of transfer to railway cars for shipment to the creosoting plant.

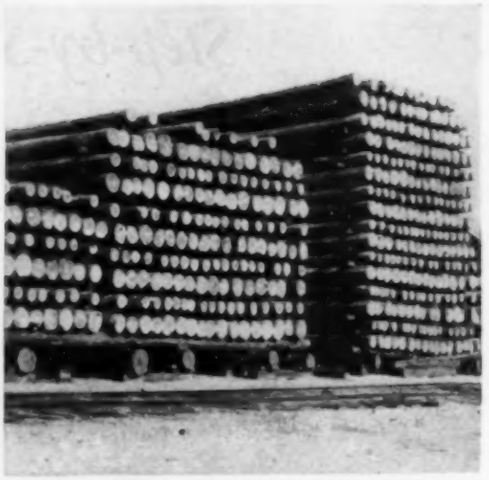


4 AT THE RAIL HEAD logs coming in from the woods are deposited upon a framework elevated above ground level. With cant hooks they are turned over, carefully inspected, branded with a hammer and then hoisted up inclined ways into railway cars.

Continued on Following Pages



5 ARRIVING AT THE YARD of the Texas Creosoting Company's plant, the logs are unloaded from the railway cars by a locomotive crane and stored until ready for the creosoting process.

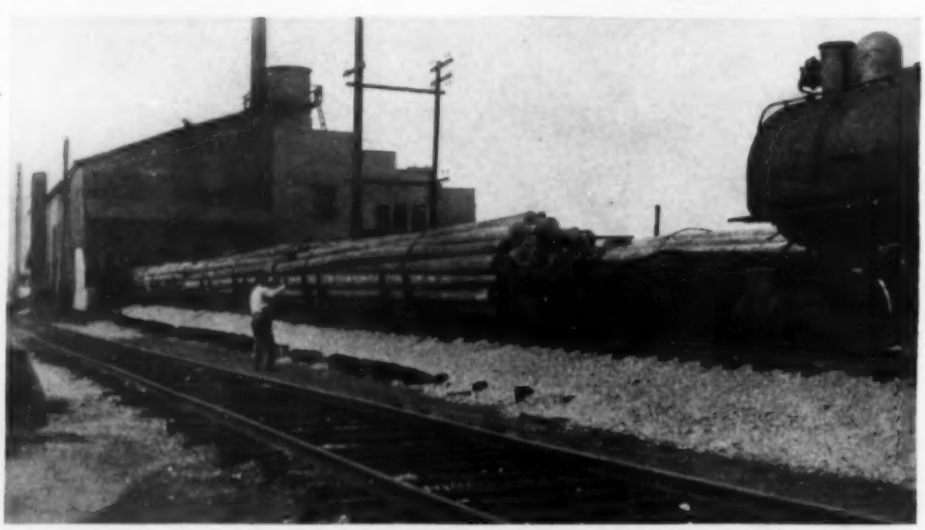


6 SORTED INTO STOCK PILES the untreated poles are stacked on creosoted skids. Treated spreader strips separate the tiers and insure proper circulation of air. The yard surface is of sand, kept scrupulously clean of weeds or other vegetation.

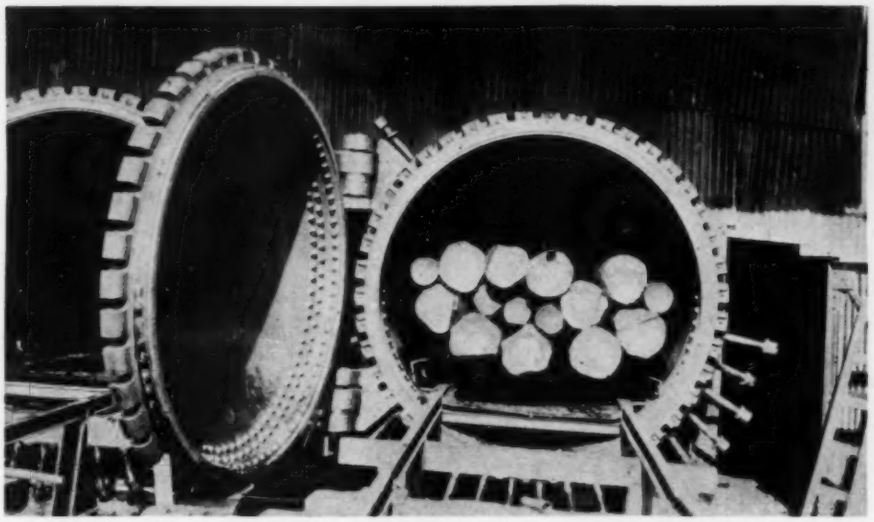
7 FRAMING OF THE POLES, after a proper period of seasoning, but before treatment, is done by sawing. After the poles are "roofed" and "gained," they receive a third inspection.

8 HOLES for attachment of wood cross-arms to carry transmission line wires are bored at the proper points.

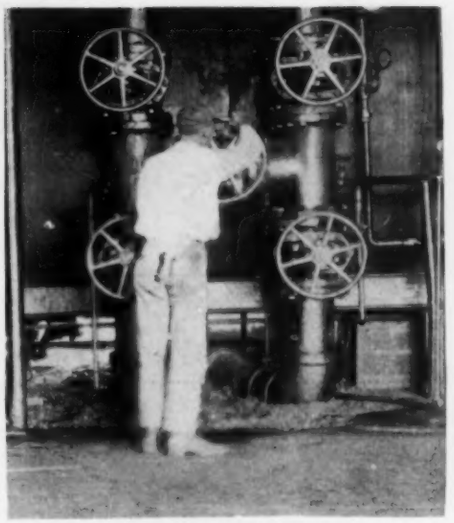
9 BRANDING of the poles passing final inspection is the last operation performed before they are subjected to the creosoting process.



10 BUGGIES hauled by a steam locomotive receive the poles ready for treatment and deliver them to the treatment cylinders.

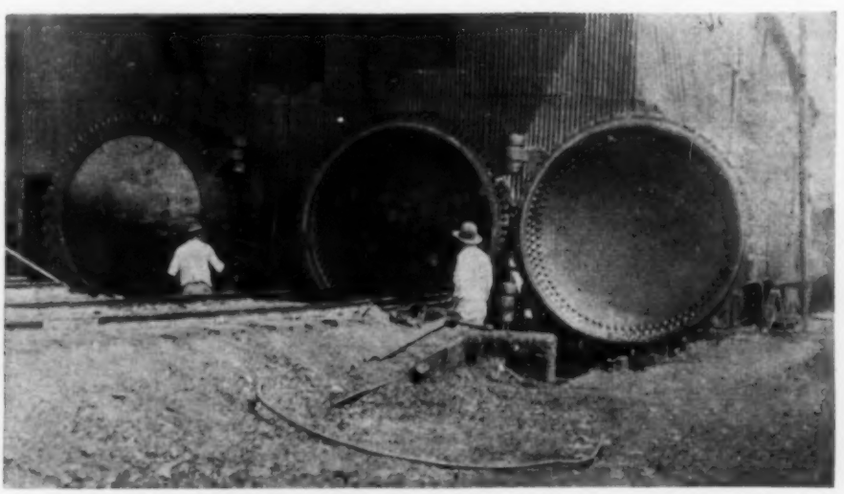


11 IN STEEL CYLINDERS, 18 ft. in diameter and 125 ft. long, the creosoting process is carried on. After cylinder doors are bolted, the poles are first steam dried under pressure and then subjected to a vacuum to expel the sap. Air pressure is then applied and hot creosote oil forced in against it, filling the cells of the wood. Pressure is then released and a vacuum formed to allow air imprisoned in the wood to expel excess creosote oil.

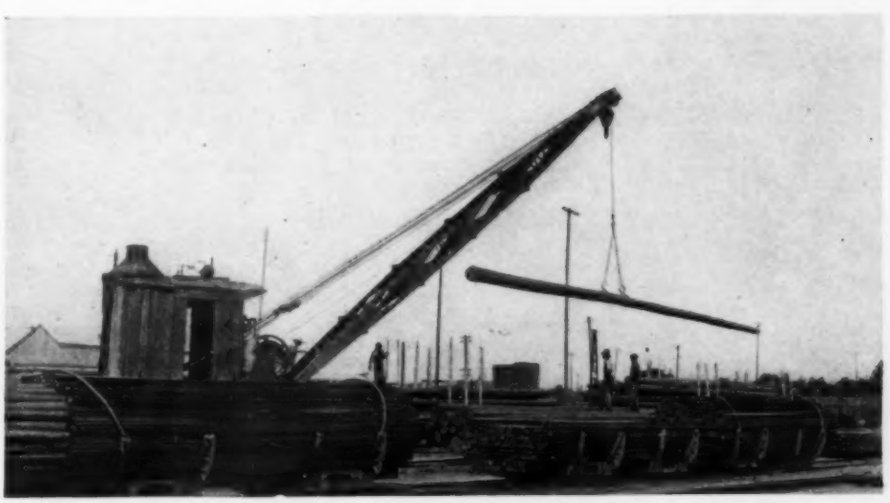


12 OPERATOR OPENS VALVE allowing hot creosote oil under pressure to enter treatment cylinder.

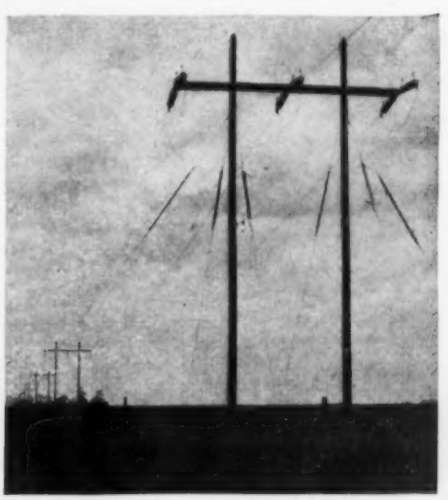
13 WHY PRESERVATIVE TREATMENT is desirable. Untreated pole ravaged by termites.



14 AFTER TREATMENT the cylinder doors are unbolted and the poles, in their railway buggies, are run out along the track into the plant yard for storage as treated stock



15 FROM THE BUGGIES the treated poles are removed by a locomotive crane and stacked ready for shipment to the job. Each pole is numbered and has a "pedigree" or record of date of arrival, time of seasoning, amount and kind of preservative treatment, hours treated, pressures and temperatures.



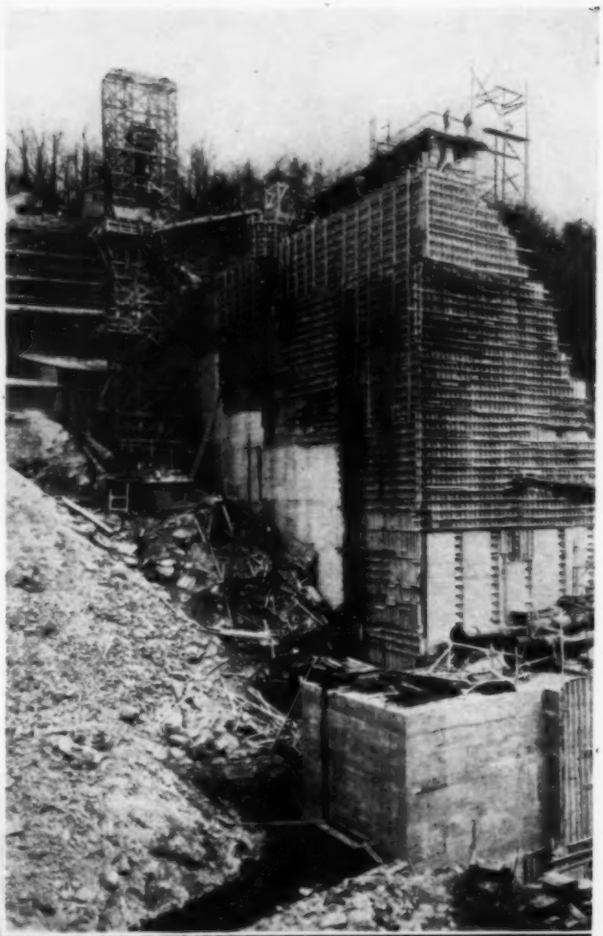
16 FINALLY, the treated pole reaches the field and is erected to carry an electric power transmission line.

TUBULAR TOWERS

Support Belt Conveyors Distributing Large-Aggregate Concrete

BELT conveyors supported on tubular steel towers are delivering large-aggregate concrete from the mixing plant to hoppers on the Prettyboy dam, now under construction by the J. A. La Porte Corp., of Albany, N. Y., for the Department of Public Works of Baltimore, Md., on the Gunpowder River, 22 mi. north of the city. The new dam will impound twenty billion gallons which can be discharged as required to the Loch Raven reservoir downstream, eliminating need for a new pipe line to tap an additional supply.

Dimensions and Quantities—The dam is a concrete gravity overflow structure with its spillway crest 153 ft. above foundation rock. A concrete cutoff wall extends 15 ft. below the foundation, and a highway bridge crosses the dam at an elevation, measured to sidewalk level, 20½ ft. above the crest. In the center of the spillway is the gatehouse, projecting 29 ft. upstream from the face of the dam and containing two 54-in. cast-iron outlet pipes fed by vertical wells equipped with sluice gates at three levels. The bridge crosses the



PIPE TOWERS, carried up through concrete as height of dam increases, support belt conveyors delivering large-aggregate concrete from hoisting tower at mixing plant to distribution hoppers from which buggies take concrete to placing point. Pipe scaffolding also carries plank runways for buggies. Temporary bypass tunnel is left open under gatehouse section. MIXING PLANT *(above)* is equipped with two 2-yd. mixers which discharge into hopper behind hoisting tower.

ADDITIONAL EXCAVATION at west end of dam, required by weathered condition of mica schist, is carried into sound rock. Rough excavation for west apron and west half of pool is completed. Gravity abutment will be continued into excavated area, where a transition section will narrow down from gravity section to core wall extending sufficient distance into rock slope to insure water cutoff. Rolled clay embankment will be placed on both sides of wall.

spillway on four 68½-ft. clear concrete-arch spans, two on each side of the gatehouse.

Length of the bridge is 692½ ft. Extensions to the dam at both ends for cutoff walls amount to 162½ ft., giving the concrete structure a total length of 855 ft. Base width of the highest part of the dam is 122 ft., and the maximum length of apron below the toe is 93 ft. Concrete requirements aggregate 190,000 yd., and excavation totals 400,000 yd.

Concrete Design—Coarse aggregates consist of three sizes of crushed limestone or crushed trap rock, with the addition, for mass concrete, of cobbles passing a 9-in. and retained on a 4½-in. square mesh. The three grades of crushed rock (⅜ to ¾ in.; ¾ to 1½ in.; and 1½ to 2¾ in.) are used in one, two, or three sizes according to the requirements of the structure being poured. In general, coarse aggregates are measured volumetrically and sand by weight, the sand being frequently checked for bulking by means of inundation tests and the results translated into the correct values for weight measurement. Mass concrete contains one part, by volume, of cement, seven and one-half parts, total, of sand and crushed rock, and three parts of cobbles.

Concrete Plant—Use of cobbles in the mix made it necessary to install 2-yd. mixers in the concrete plant, as smaller mixers cannot pass stone of this size. The plant is equipped with two 2-yd. Smith tilting mixers. Use of large aggregate further required wide gate openings in the hoppers at the mixing plant and on the dam. The hopper gates at the plant are operated by air hoists; those on the dam are opened and closed by hand. Where the concrete is dropped vertically from the conveyors to the hoppers, large-size elephant trunk spouts have to be used.

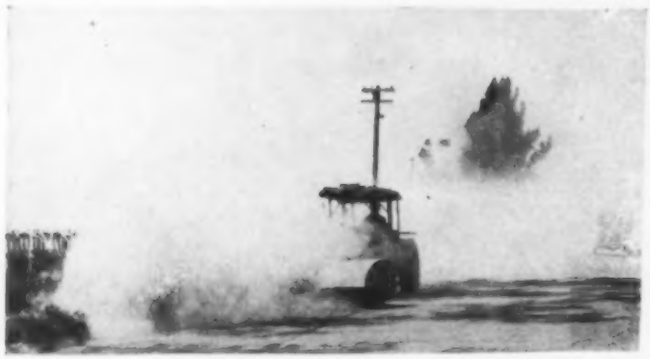
Concrete aggregates are delivered by truck to bins from which they pass to Johnson volume and weight hoppers discharging on to a conveyor belt. The belt delivers to the two mixers, which discharge into a hopper beside a hoisting tower. From the hoist, concrete is transported by belt conveyors mounted on pipe towers which are carried upward through the concrete as the work progresses. Similar pipe scaffolding supports the sectional plank runways over which the concrete is distributed by hand buggies from the hoppers in the towers to the placing point.

Administration—B. L. Crozier is chief engineer of the department of public works, Leon Small is water engineer, and C. B. Cornell is construction engineer in charge of the job. Photographs and notes for this article were supplied by Mr. Cornell. Frank Carpenter is superintendent for the J. A. La Porte Corp.

California Highways

BITUMINOUS

By T. H. DENNIS
Maintenance Engineer,
California Division of Highways



1 BROOM cleans surface of highway before prime coat of emulsified asphalt is applied.

ON WELL consolidated rock roads subject to moderate traffic the California Division of Highways makes extensive use of an "armor-coat" wearing surface consisting of thin spreads of rock and applications of heavy asphaltic oil (either emulsion or heated). The result provides a smooth surface at costs ranging from $2,000 to $2,500 per mile, depending on location, and is quite comparable to the annual maintenance cost plus interest on the investment considering the road material lost in a season if the surface is unconsolidated.

Highways on which this light wearing surface can be used must have a sound base and be comparatively

2 COATING of ¼ gal. per square yard is applied as priming.

3 CRUSHED STONE *(right)* is spread evenly on coated surface of road by fan-tail distributor on rear of truck, running backwards.

4 BLADE GRADERS *(left)* distribute screenings uniformly and are followed by power roller.

smooth and properly shaped because the limited thickness of the application permits only minor roughness to be taken out of the base. As little reshaping is done as is necessary to keep the gravel or macadam locked in its original position. Local depressions and irregularities in the surface are patched and the surface trued up as the preliminary step in the process.

Specifications require 90 lb. of rock

Are Resurfaced With
ARMOR-COAT

per square yard and, when using asphaltic emulsion, ¾ gal. per square yard or 8,800 gal. per mile. The usual steps used in applying this surfacing are: (1) Prime coat of ⅛ gal. of emulsified asphalt per square yard. (2) Prime coat covered with 50 lb. of clean screening (½- to ¾-in. size) per square yard, rolled and swept. (3) Application of ¼ gal. emulsified asphalt per square yard. (4) Second application of screenings (⅛- to ½-in. size) amounting to 20 lb. per square yard, spread, rolled and swept. (5) Application of ⅜ gal. of emulsified asphalt per square yard. (6) Screenings (⅛- to ¼-in. size) spread at a rate of 20 lb. per square yard, rolled and swept.

The emulsified asphalt used in some of this work is a commercial grade with 55 per cent asphalt emulsion which has a very rapid break.

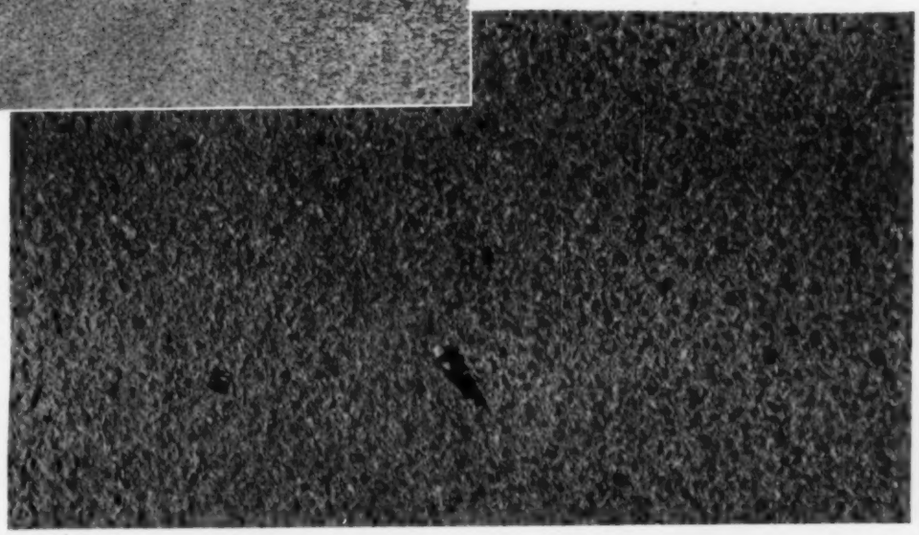
5 PRESSURE DISTRIBUTOR applies ¼ gal. per square yard of 90-95 road oil at temperature of 400 deg. F.

6 ROLLING AND BROOMING *(above)* prepare road surface for subsequent applications of oiling and stone covering.

7 COMPLETED SECTION *(above)* of armor-coat road surfacing along Smith River.

Each application of emulsion is covered uniformly with stone dumped from a spreading device on the tailgate of a truck operated in reverse so that the wheels do not come into contact with the freshly spread material. Following some hand-spotting and brooming, each spread of stone is rolled once and then a power broom is used to remove stone not firmly embedded in the preceding course.

8 TEXTURE *(below)* of armor-coat bituminous surfacing indicates non-skid properties.

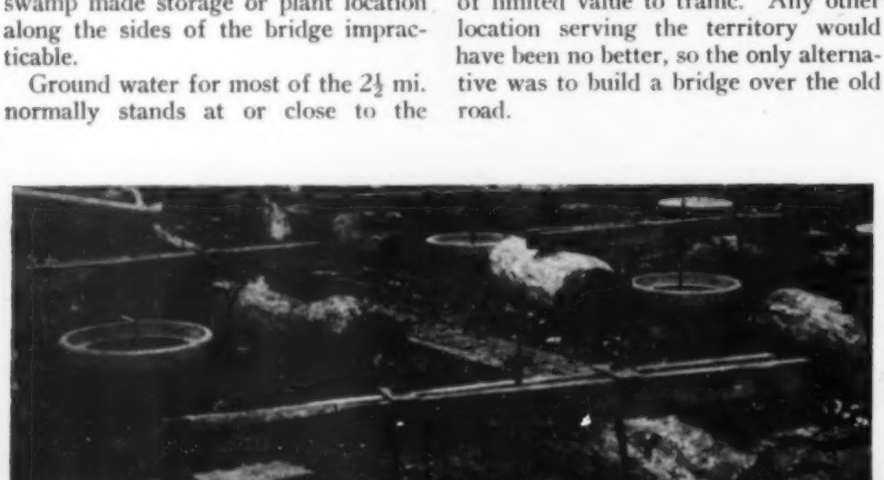


CONCRETE CAPS on timber piles along edges of sunken concrete road. Drift pins in top of each cap engage sills of timber superstructure.

Sunken Road Across Swamp Bridged by TREATED TIMBER DECK *on Concrete-Capped Wood Piling*

MATERIAL handling on 2½-mi. of timber pile and deck bridging complete recently over a sunken concrete road in the northeastern part of North Carolina had to be planned so that traffic was not impeded, although the water-logged swamp made storage or plant location along the sides of the bridge impracticable.

Ground water for most of the 2½ mi. normally stands at or close to the surface. Under certain tidal conditions the old concrete road would be submerged as much as 3 ft., with long closings of the route not uncommon. Under traffic the slab also had sunk irregularly into the swamp muck soil until some sections of the road were of limited value to traffic. Any other location serving the territory would have been no better, so the only alternative was to build a bridge over the old road.



CONCRETE PIPE FORMS for pile caps hung in place from timbers on shores laid in swamp.

A creosoted timber deck structure on untreated timber piles proved to be the most practicable solution of the problem. By driving a row of piles along each edge of the slab, with the two rows spaced 10 ft. on centers, and then spanning the slab with heavy timber girders, it was possible to avoid blocking the old road except for stretches of 800 ft. at a time. Detours through the swamp were out of the question, so traffic was carried around successive construction sections on a temporary bridge that was practically floated on the surface.

Driving Piles

After a portable driver with 75-ft. leads equipped with a Vulcan hammer worked down one side of the road placing the piles on that side for 800 ft., it was shifted across to drive the piles on the other side on the trip back. Then the piles were sawed off and capped with concrete.

The form for each concrete cap consisted of a piece of plain concrete pipe, 30 in. long, 18 in. in diameter and belled on the upper end. After the pile head had been cut off, a hole was dug around it to permit placing the concrete pipe section. The latter was then hung from a pair of timbers shored up on blocking laid on the ground. A ring of strap iron, made in two parts that could easily be assembled and dismantled with keys, was placed under the bell on the pipe. Two threaded rods engaging this ring extended up between the supporting timbers on the blocking. Washers on these threaded rods took bearing on the timbers so that nuts on the rods could be adjusted

ASPHALTIC CONCRETE *(below)* **forms wearing surface on roadway of timber superstructure. Old concrete slab may be seen under the bridge.**

HEAVY TIMBER SILL *(above)* **swung into place with hand hoist on boom built out over rear end of motor truck that operated on old road slab.**

TEMPORARY BRIDGE *(left)* **detours traffic around 800-ft. section of timber superstructure under construction. Material in this detour was used repeatedly.**

to bring the top of the pipe exactly to grade.

Having aligned the pipe correctly, material was tamped around the outside to hold it in place. Then the water and mud were carefully removed from the inside and the pile head washed clean. Next the concrete was poured and finished accurately to grade.

The timber caps, girders and decking were cut to exact dimensions before delivery. The girders also were notched to give the right crown to the roadway. Rail delivery was made to one end of the job and trucks brought the timbers to the location they were to occupy in the structure.

By properly spacing the caps and the girders along one side, and the decking along the other side, all rehandling on the job was avoided. A truck equipped with a light cantilever boom carrying a 2-ton hand chain block was used for swinging the timbers from the storage piles to place. A compressor on this truck also furnished air used to run the pneumatic tools used on the job.

The 14x16-in. 21-ft. timber caps were laid lengthwise at the edge of the old road slab. With the hand hoist on the boom on the rear end of the truck, one cap was picked up at a time swung around over its pair of piles and the exact location of the holes for the drift pins found. Then the holes were bored and the cap swung back on the drift pins to rest on the concrete caps of the piles.

After the sill-setting crew got a little start, a second crew followed to place the girders. Behind them was a third crew lining and nailing the stringers. A fourth crew placed the decking. With all of the decking in position, four crews of five men each nailed it down with 28-oz. air hammers. One five-man crew could nail 115 to 125 lin. ft. of decking a day. Usually, one of the 800-ft. sections of the timber structure above the piles was completed in from 3½ to 4 days.

When the entire structure was built, the roadway was surfaced with 1½ in. of cold-laid asphaltic concrete. This was placed in strips half the width of the roadway, so traffic could continue to move. The temporary bridge detours were around the 800-ft. sections of the decking work only. The material in these detours was used repeatedly, so that it paid to cut and frame it accurately.

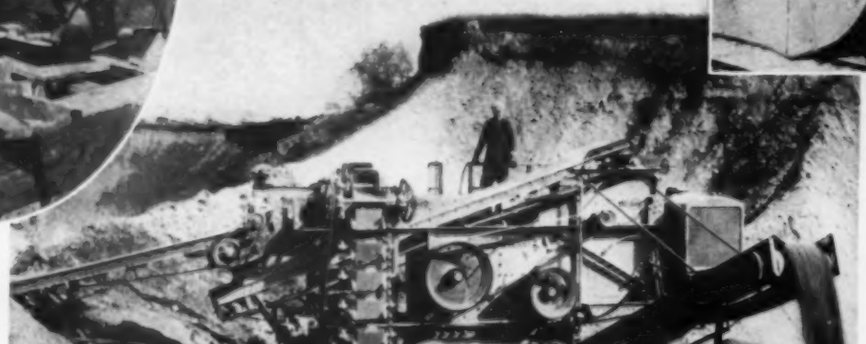
Personnel

On account of the impracticability of specifying the details of the work with close accuracy and for other reasons the job was handled by force account by the North Carolina State Highway Commission, of which J. D. Waldrop is state highway engineer, W. L. Craven, bridge engineer, and C. B. Taylor, bridge maintenance and construction engineer. F. D. Summers was in charge during the first part of the work and W. K. Norman, who was his assistant during that time, had charge for the balance of the job.

NEW EQUIPMENT *on the Job*

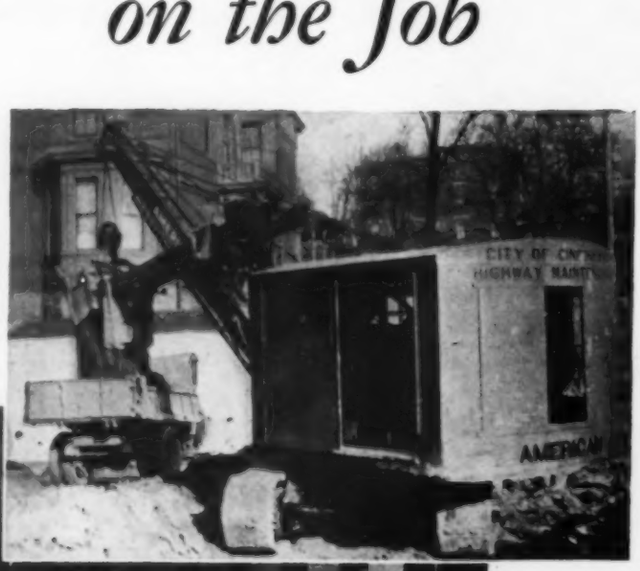
CONCRETE BUCKET for derrick or cableway operation and also for use as floor hopper for loading buggies, wheelbarrows or discharging into chutes. Radial gate for opening and closing, controls discharge. Made in hook-on and two-line types which are easy to spot, watertight and assure full delivery of batch without loss of aggregate. Three sizes: 18-, 33- and 63-cu.ft. capacity. — Blaw-Knox Co., Pittsburgh, Pa.

LARGE CAPACITY PORTABLE CRUSHING AND SCREENING PLANTS *(below)* producing up to 1,000 yd. per day, designed to accommodate either single or both primary and reduction crushers. Overall dimensions: Height, under 12 ft.; length, exclusive of pit conveyor, under 26 ft., and width, exclusive of delivery conveyor, under 10 ft. Operating and traveling clearance 11 in. above ground. When moving from one location to another, it is only necessary to disconnect pit and delivery conveyors. Anti-friction bearings used throughout. Equipped with new type of pivoted bucket carrier which returns crushed product to screen.—Austin-Western Road Machinery Co., Chicago, Ill.



CLEAN-UP REHANDLER CLAMSHELL BUCKET for operation with any type of equipment having two drums. Scoops designed to cover large area. Extended corner brackets give extra digging leverage. Narrower and more rigid head resists twisting strains. Has power arm combination of lever and block-and-tackle giving faster rehandling by developing high digging power with minimum cable overhead. Sizes ¼- to 3-yd. — Wellman Engineering Co., Cleveland, Ohio.

SHOVEL - CRANE - DRAGLINE *(right)*, operated by gasoline or diesel engines, in five sizes, ¾, 1, 1¼, 1½ and 1¾ yd., mounted on continuous chain crawler treads, with two speeds. — American Hoist & Derrick Co., St. Paul, Minn.



ARC-WELDER *(left)* with single current control, self-exciter feature and internal stabilizer, designed for field and general repair shop service. Made in 100- to 800-amp. sizes. Manufacturing rights for Hansen welder were recently acquired by present owner. — Harnischfeger Corp., Milwaukee, Wis.

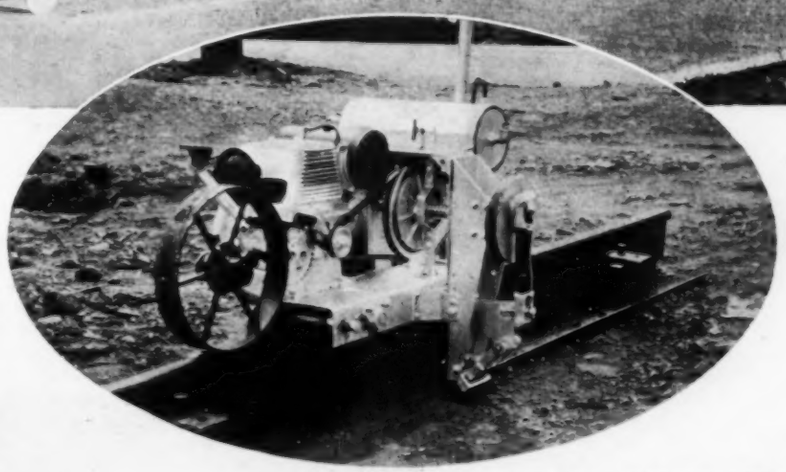
If You Want Further Information

Within the space limits of these pages it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them, referring to this issue of *Construction Methods*.

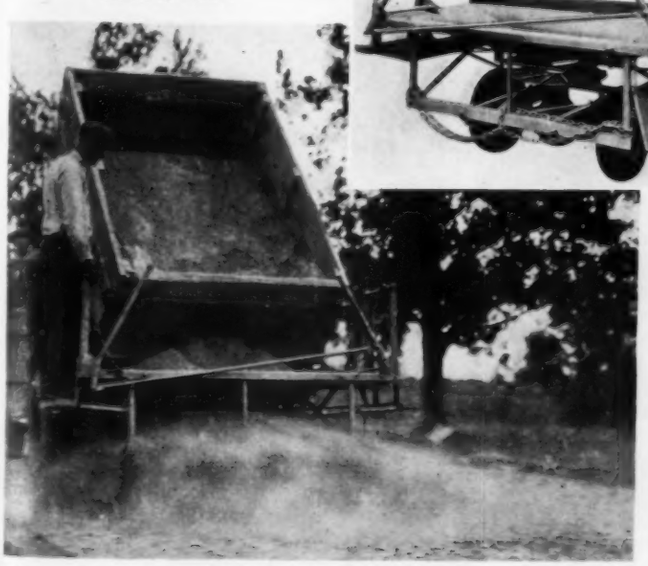
ELECTRICALLY - OPERATED SURFACE DETECTOR *(below)* called the "Rid" automatically indicates, by buzzing, high and low spots in newly constructed pavement. Made of high-strength aluminum alloy. Length, when folded, 65 in. Weight, 21 lb. Runs forward or backward with equal facility and checks job in one-third time required by ordinary straightedge.—The Cambridge Corp., Homewood, Ill.

ROAD - BUILDING BULLDOZER designed with 36-in. lift for use with tractor in building trails, motor roads in mountains, fire breaks and wagon trails. Strongly reinforced main frame completely surrounds tractor. Carbon-steel moldboard, ⅜ in. thick, rolls earth forward and to one side. When set at 30-deg. angle blade performs function of both bulldozer and backfiller. Heat-treated cutting bits at each end of blade act as side cutting edge and also as landside to prevent blade from digging too deeply into cut.—LaPlant-Choate Mfg. Co., Cedar Rapids, Iowa.



DIFFERENTIAL DISK SPREADER *(below)* for use by macadam road builders and resurfacing contractors. Material from truck drops on disk revolving in horizontal plane and powered through traction of two wheels supporting spreader. Wheels are equipped with pneumatic balloon tires and drive back through a standard automotive type of 4-pinion differential to vertical shaft on which disk is mounted. Combination of rubber tires and differential action prevents any disturbance of interlocked stone surface and distributes material uniformly, permitting a spread of 16 ft. (30 ft. on anti-skid work).—Universal Crane Co., Lorain, Ohio.

MECHANICAL, PORTABLE FORM-TAMPER *(above)* developed to obtain a smoother pavement by insuring a thoroughly tamped base, thereby eliminating form settlement under subgrade shaping and concrete placing equipment. Unit, when started by operator, runs on forms without further attention. It also oils inside face of forms. Tampers operate on both sides of forms. Forward travel 25 ft. per minute.—Lakewood Engineering Co., Columbus, Ohio.



MECHANICAL JETTER *(right)* for settling earth fills before concrete is laid. "Fil-Jetter" consists of three jets spaced on 5-ft. centers with maximum working depth of 8 ft. 6 in. Equipped with removable steel nozzles and mounted on two roller bearing 42-ft. diameter wheels with 6-in. wide tires. Operated at 40- to 60-lb. pressure. Steel pole provided for trailing. —C. H. & E. Mfg. Co., 10 E. Mineral St., Milwaukee.

Present and Accounted For —

A Page of Personalities

FREDERICK C. SCHNEIDER *(below)* roadbuilding contractor of New Brunswick, N. J., has been elected president of the New Jersey Constructors Association. He was formerly engineer of Middlesex County and city engineer of New Brunswick. In addition to his road-building activities, Mr. Schneider is United States Marshall for New Jersey.

Harris & Ewing

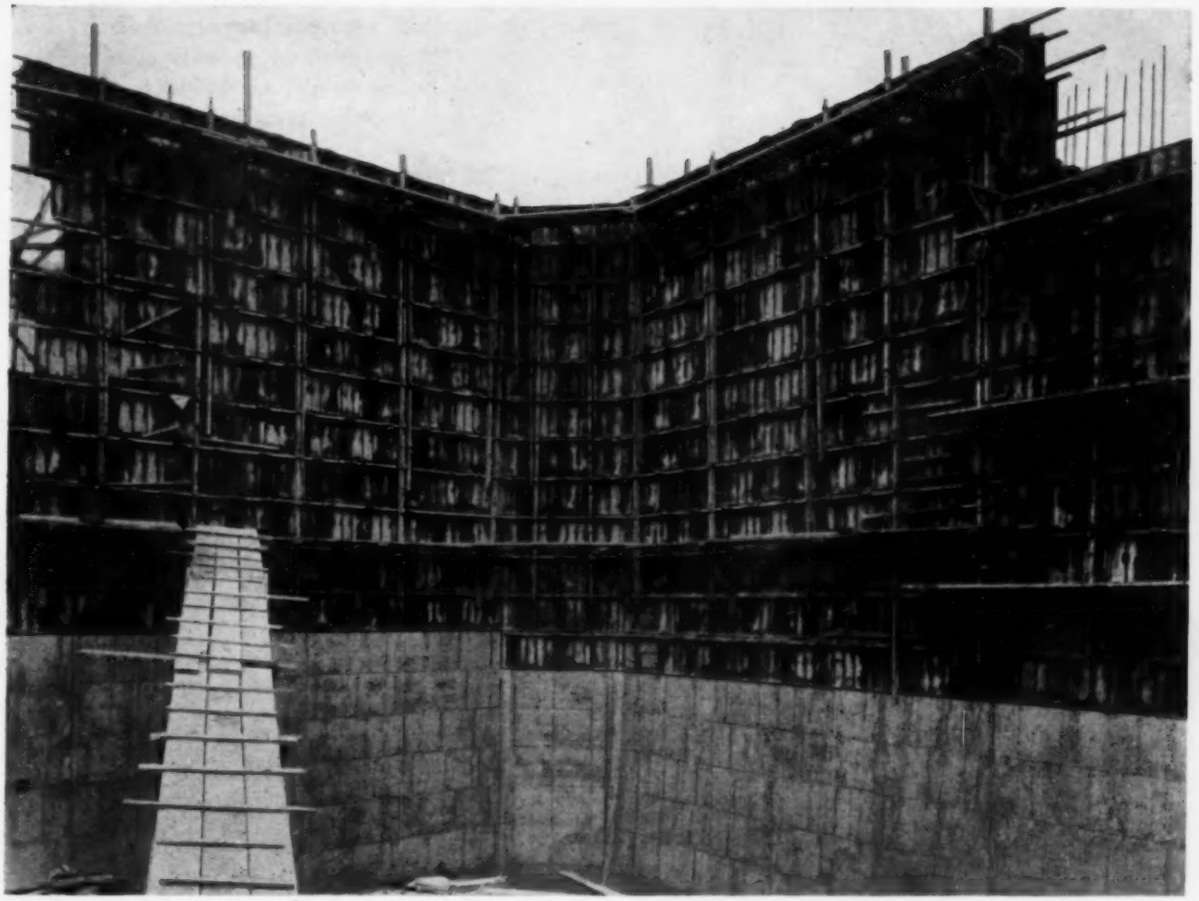
COL. HARLEY B. FERGUSON, Corps of Engineer, U. S. Army, has been appointed by the Secretary of War to serve as chairman of the board to review the engineering features of the Mississippi River flood control project. The board, which includes Col. George R. Spalding and Dean Anson Marston of Iowa State College, was created under the resolution written by Riley J. Wilson, chairman of the flood control committee of the House of Representatives.

MARTIN W. WATSON *(below)* is the newly elected president of the Kansas Contractors Association. He is president of the Topeka contracting firm that bears his name and served the association for two years as vice-president. Mr. Watson was formerly road engineer with the Illinois Division of Highways and, later, state highway engineer of Kansas.

JOHN J. CASEY *(below)* has been appointed, by the Board of Public Works, city engineer of San Francisco, succeeding M. M. O'Shaughnessy, recently transferred to the post of acting chief engineer for the Public Utilities Commission. Mr. Casey has been in the city service 17 years as engineering inspector.

DR. CHARLES CAMSELL, deputy minister of mines, Dominion of Canada, was elected president of the Engineering Institute of Canada at that organization's recent forty-sixth annual meeting.

ALFRED J. CLEARY *(below)*, formerly executive secretary to Mayor Rossi, has been appointed under the terms of the new city charter administrative officer of San Francisco, with jurisdiction over eleven municipal departments. He served the city 10 years as assistant and chief assistant engineer on the Hetch Hetchy water supply project.



Make Sure of Lowest Form Construction Costs

The 34-ft. wall shown above was built with Metaform units, illustrated below, 2-in. x 4-in. "liners", and braced only on one side.

BUILDING concrete forms is simplified and thus speeded up with "Metaforms"—steel form units. Stripping them is equally simple and fast and handling easy. Costs are thus reduced, time saved.

These steel form units are so flexible in building forms and can be so universally used on concrete construction that they become easily the greatest factor in raising the efficiency of any contractor's organization. This fact, in itself, reduces costs. No labor is diverted to non-productive salvaging with "Metaforms". But they endure hard usage for years—long after their moderate cost has been written off.

Metaform Engineers have worked to simplify and speed up concrete form construction with easily handled, enduring, steel units. Their success is now resulting in known form construction costs, costs so dependably lower than with other methods and materials that a small number of reuses of Metaforms actually pays for them.

If you work with Concrete, "Metaforms" will help you make sure of your costs and your profits. Send for latest "Metaform" bulletins.

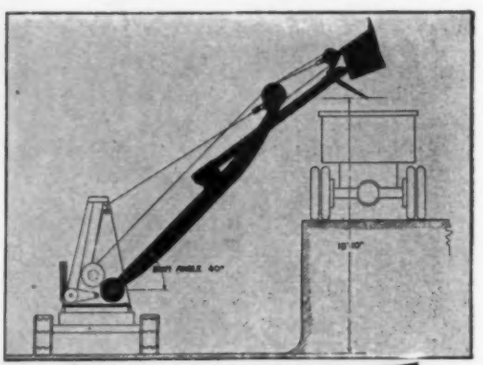
METAL FORMS CORPORATION, Milwaukee, Wis.

Metaforms

A comparison of five competitive shovels with booms set at 40° shows a dumping height of

13′ 10″ . . . . . in the AUSTIN BADGER
12′ 8″ . . . . . in SHOVEL A
11′ 11″ . . . . . in SHOVEL B
12′ 0″ . . . . . in SHOVEL C
11′ 6″ . . . . . in SHOVEL D

The IMPROVED design of the Austin Badger makes it the Biggest little shovel on the market!



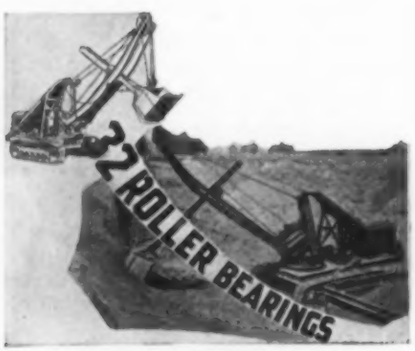
MORE DUMPING HEIGHT

From 1′ 2″ to 2′ 4″ greater dumping height is provided by the Austin Badger, making it the ideal shovel for basement excavation and other high lift jobs.

Greater dipper capacity (1 cu. ft. or more), roller bearings on all moving parts forward of the power plant (thirty-two in number), greater portability and complete convertibility are other features of the Austin Badger that should influence your selection of this biggest of all little shovels.

In the Austin Badger you get a plus ⅜ yard (11 cu. ft.) shovel, amply powered, fully convertible for crane, dragline or back filler, an all-purpose utility tool for speedy economical operation.

Let us send you prices and operating data, and a copy of Bulletin No. 1236.



A COMPARISON OF FIVE COMPETITIVE SHOVELS FINDS IN THE

AUSTIN BADGER . . 32 roller bearings
SHOVEL A . . . . . 10 roller bearings
SHOVEL B . . . . . 7 roller bearings
SHOVEL C . . . . . 7 roller bearings
SHOVEL D . . . . . 6 roller bearings

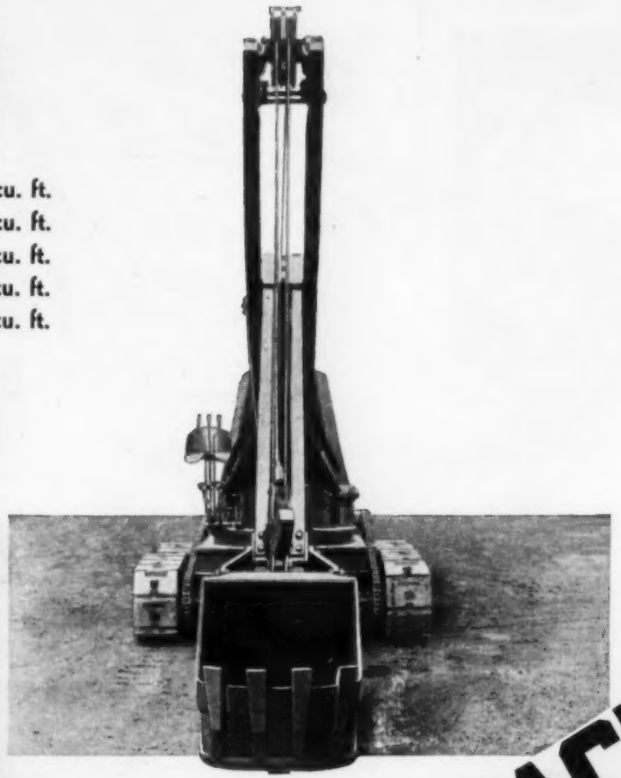
The IMPROVED design of the Austin Badger makes it the Biggest little shovel on the market!

AUSTIN-

A comparison of five competitive shovels shows a dipper capacity on the

AUSTIN BADGER . . . . . of 11 cu. ft.
SHOVEL A . . . . . of 10 cu. ft.
SHOVEL B . . . . . of 10 cu. ft.
SHOVEL C . . . . . of 10⅛ cu. ft.
SHOVEL D . . . . . of 10⅛ cu. ft.

The IMPROVED design of the Austin Badger makes it the Biggest little shovel on the market!



GREATER DIPPER CAPACITY

Measure the dipper area! Note that only the Austin Badger offers a plus ⅜ yard (11 cu. ft.) dipper while most shovels are 10 cu. ft. or minus ⅜ yard. This greater dipper capacity (a cu. ft. or more) means many, many more yards per day.

Other Austin Badger features too deserve your consideration—thirty-two roller bearings provide smoother, faster operation—more dumping height (1′ 2″ to 2′ 4″) means more flexibility of application—greater portability provides faster transportation from job to job—and low cost of operation means fuel and maintenance savings. The Austin Badger is backed by seventy-four years of making and selling earth moving and road maintenance tools.

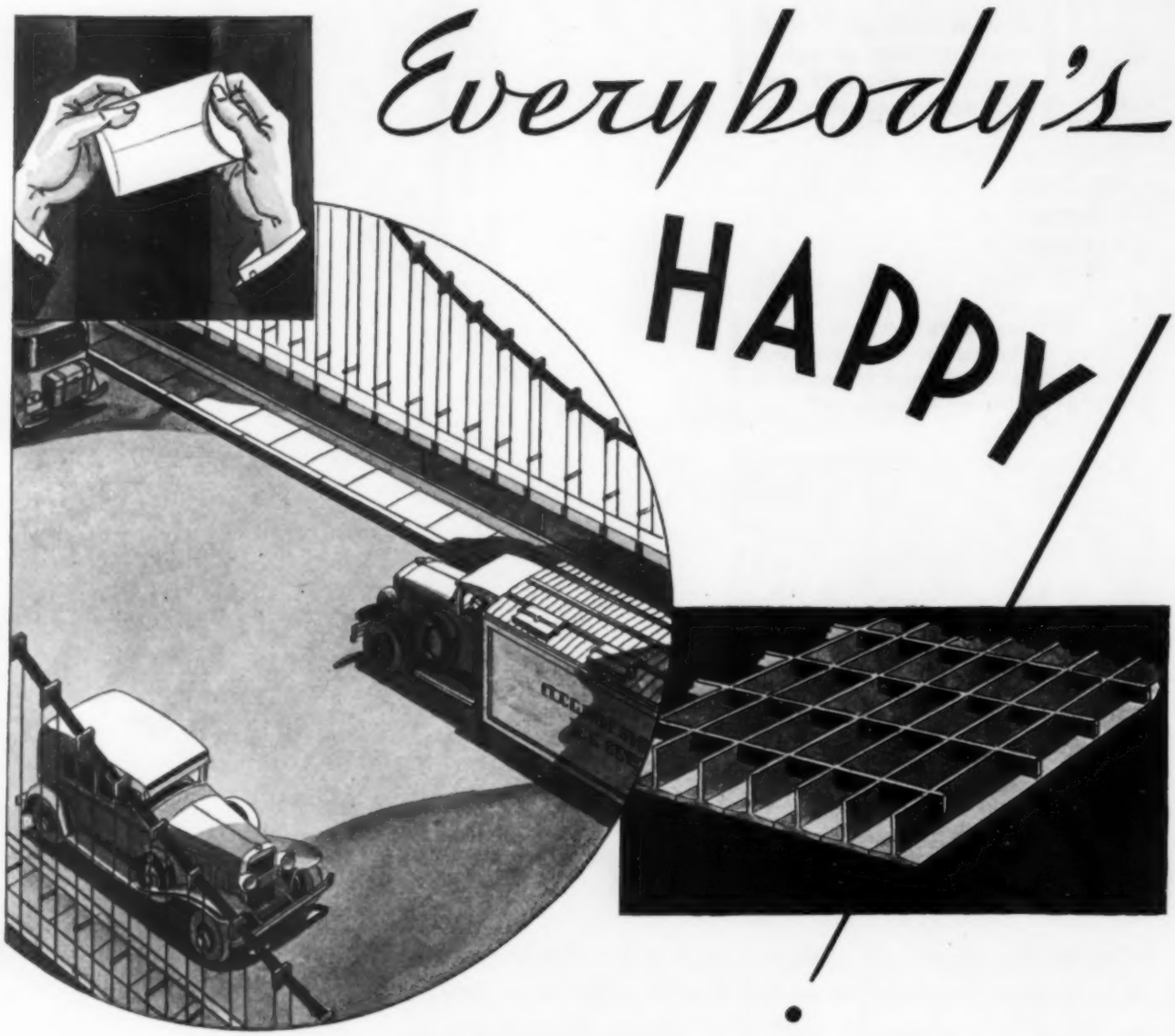
The Austin-Western Road Machinery Co., 400 North Michigan Avenue, Chicago, Illinois. S-324

A COMPARISON OF FIVE COMPETITIVE SHOVELS FINDS THE QUESTION OF PORTABILITY ANSWERED AS FOLLOWS:

AUSTIN BADGER . . offers a low cost pair of wheel mounts.
SHOVEL A . offers a high priced pair of trucks.
SHOVEL B . . . offers an expensive trailer.
SHOVEL C . offers no transporting equipment.
SHOVEL D . . . offers an expensive trailer.

The IMPROVED design of the Austin Badger makes it the Biggest little shovel on the market!

WESTERN



THE bridge is finished. The contractor has his final payment. Motor traffic untangles itself from the congestion and breathes a sigh of relief. Another traffic problem has been cleared off the boards at the city engineer's office. All this, ***weeks ahead of the expected time!***

T-TRI-LOK Bridge Floor Construction is responsible. Rapidly installed, strong, permanent, fireproof, light in weight, T-TRI-LOK provides an efficient and economical solution to bridge roadway problems. T-TRI-LOK is furnished in standard units in widths up to 4 feet and in lengths up to 40 feet. Units are placed directly on bridge stringers and secured by bolting, riveting, welding or clipping. The cells are then filled flush with concrete, preferably vibrated into place, forming an armored concrete, non-skid wearing surface of long life and high efficiency. No forms for concrete are required.

If you are interested in rapid, yet efficient bridge floor construction, send for our T-TRI-LOK booklet.

CARNEGIE STEEL COMPANY · PITTSBURGH, PA.

Subsidiary of United States Steel Corporation

173

T-TRI-LOK

Tarmac *has* Infaration*

WHAT IS
*Infaration?

See next page

WHAT IS

*Infaration?

*Infaration is that quality of a bituminous material which causes effective penetration combined with maximum bonding power.

Gravel road in Payson Park, Portland, Maine. Treated with double application of Tarmac P and stone chips.

Infaration is Greater Penetration combined with Greater Bonding Power

Infaration is Permanent Skid Resistance

Infaration is Greater Road Stability

Infaration gives Tarmac the ability to penetrate effectively under all the conditions it is called upon to face in road and street work. *In initial treatments*, it penetrates thoroughly so that the resultant surface becomes an integral part of the road and not merely a mat. *On retreatments* of existing pavements (even dense, hard surfaces like cement concrete or bituminous concrete) it penetrates so that a perfect bond is established between the old road and the new surface. *On aggregates not ideally clean* it penetrates the thin film of dust often coating the aggregate (which is particularly important in mixed-in-place, retread and the newly-developed drag surface treatments).

But to penetrate is not enough. Infaration gives Tarmac the ability to combine maximum binding power with its penetration. *In surface treatments*, this binding power gives Tarmac the ability to hold the maximum amount of covering material to the road surface with a minimum use of binder. *In mixed-in-place, and road mix construction*, this binding power makes a dense, well-bound road surface with a minimum amount of binder per square yard for a given depth of wearing surface.

The combined penetration and binding power give Tarmac surfaces greater stability and prevent waving or shoving.

Infaration increases Tarmac skid-resistance because an infarating material penetrates and binds instead of bleeding up to the surface, and because it penetrates each particle of the covering material and leaves the road granular instead of slippery. (Tarmac is less slippery in itself, as it contains no slippery, oily constituents). Insist on Tarmac for better bituminous road work.

KOPPERS PRODUCTS COMPANY

KOPPERS BUILDING PITTSBURGH, PA.

Tarmac has Infaration*

..Why you will be money ahead by using a Williams Type "MF" Multiple-Rope Bucket

It opens its mouth wider, bites in deeper, and operates faster.

DOUBLE-HINGE not only allows a wider spread of the open bucket but also a more rigid construction because of extremely short overhang of hinge shaft from the center block bearings.

SIX-PART REEVING gives straightest lead of closing cable, and longer roller guards in the head give complete protection against fraying of cable—greatly reducing cable wear and replacement cost.

RUGGED SCOOPS are scientifically shaped for hard digging.

WILLIAMS
• BUCKETS •

Williams Type "MF" Multiple-Rope Buckets must be checked against others of the multiple-rope type to be fully appreciated. *We invite comparisons.* Write for bulletin.

WE BUILD BUCKETS FROM THE VERY SMALLEST TO THE VERY LARGEST AND FOR EVERY PURPOSE

THE WELLMAN ENGINEERING CO.

7001 Central Avenue, Cleveland, Ohio

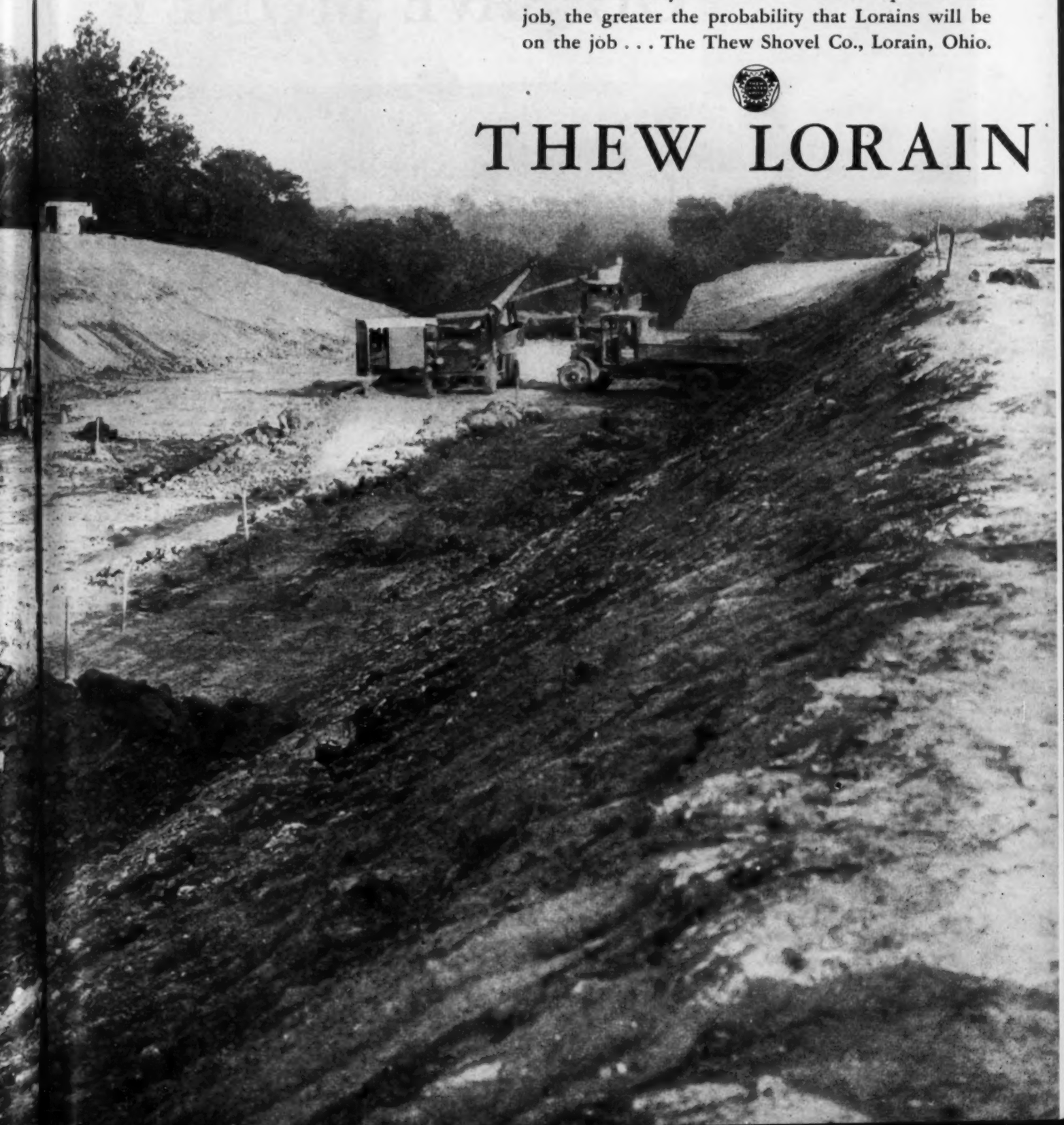
Birmingham Chicago New York Detroit Pittsburgh Mexico


THE RICHTER TRANSFER CO.
RICHTER TRANSFER Co.
CINCINNATI, OHIO.
122
LORAIN 75

ALL ABOARD!

When the Richter Transfer Co. of Cincinnati tackled this project for the B. & O. Railroad it sent two Lorain 75's and one Lorain 55 to the scene of action. 250,000 yards were handled in 5 weeks on double shift . . . This job illustrates a condition that holds true all over this country . . . that the more important the job, the greater the probability that Lorains will be on the job . . . The Thew Shovel Co., Lorain, Ohio.

THEW LORAIN



COLAS
REG. TRADE MARK

Builds BETTER ROADS

A story of growth

The two diagrams above tell the story of COLAS success far better than ten thousand words.

At present, nine factories are producing Colas at convenient points in North America; more are projected.

More than 85 factories throughout the world are required to supply the universal and ever-increasing demand for Colas.

Because . . . Colas Roads have proved economical to build and able to withstand all conditions of temperature or traffic. They are serving as satisfactorily beneath the blistering sun of Africa and India as in the zero temperatures of Maine or Northern Europe.

Colas is a method of applying—COLD—a high quality asphalt binder. Colas is quick, economical and can be applied throughout the greater part of the year. Colas provides the MAXIMUM bond with the MINIMUM amount of asphalt . . . thus Colas Roads do not bleed, are non-skid, and do not track when used by traffic immediately after laying.

There are Colas Engineers everywhere to work with you and their services are at your disposal.

SHELL OIL COMPANY • San Francisco

SHELL PETROLEUM CORPORATION • St. Louis

SHELL EASTERN PETROLEUM PRODUCTS, INC. • New York City

Licensees of Colas Roads, Inc., New York City

EXTRA YARDAGE
—EXTRA PROFIT—

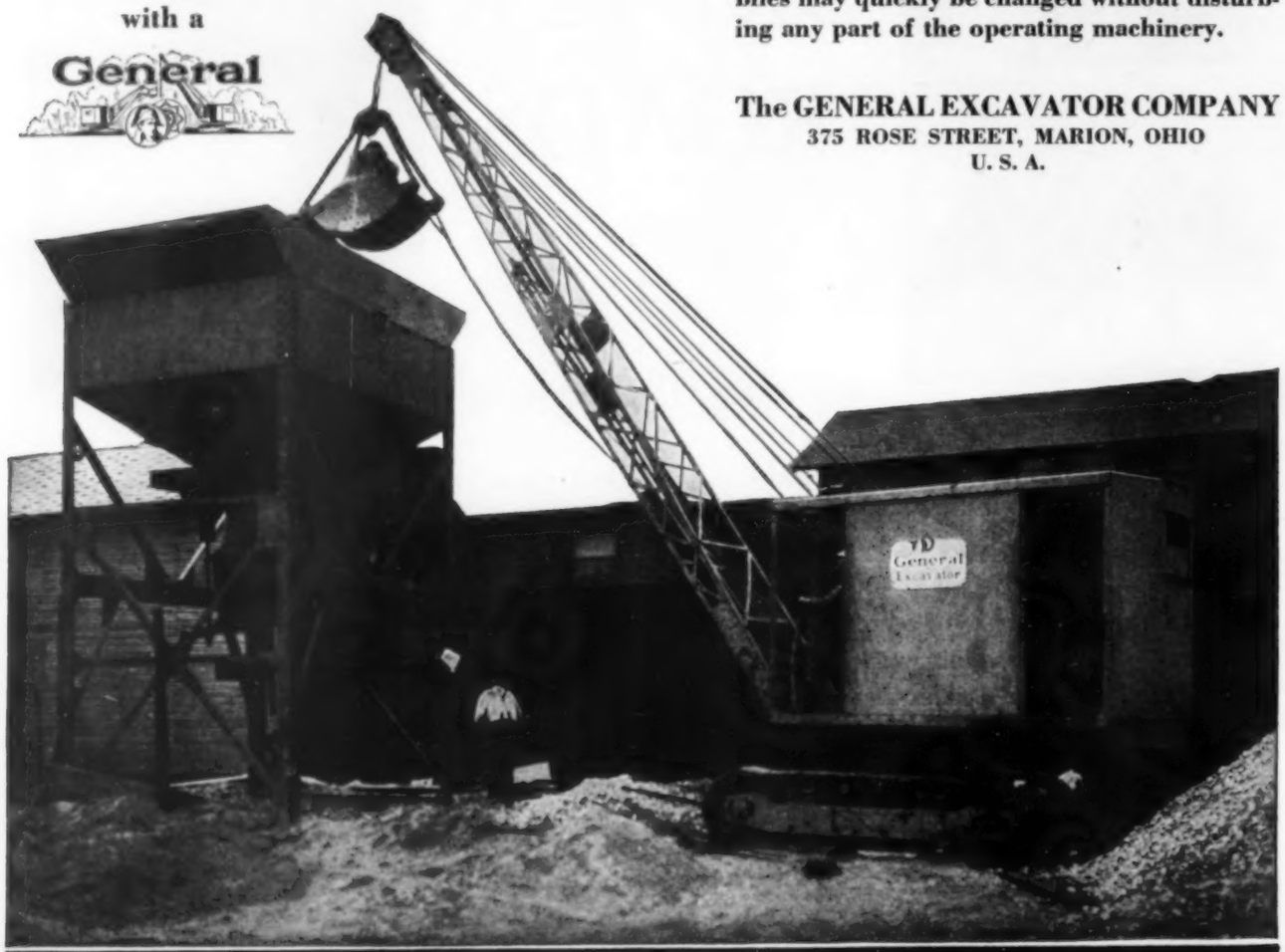
The GENERAL EXCAVATOR is rated at a half-yard capacity—but after all the REAL capacity of a machine depends upon its POWER, SPEED and ABILITY to stay with a tough job until it's done. No machine can rightly be called a half-yarder if it is powered with less than a 60-Hp. engine. The GENERAL is powered with a 62-Horsepower engine.

Big profits are assured with The GENERAL because it is the most powerful half-yarder in the field . . . It has the STRENGTH and real CAPACITY to STAND UP under the HARDEST kind of digging conditions and is convertible in the field with a boom assembly that will best handle any job. Boom assemblies may quickly be changed without disturbing any part of the operating machinery.

Anything in your way? Any material to handle?

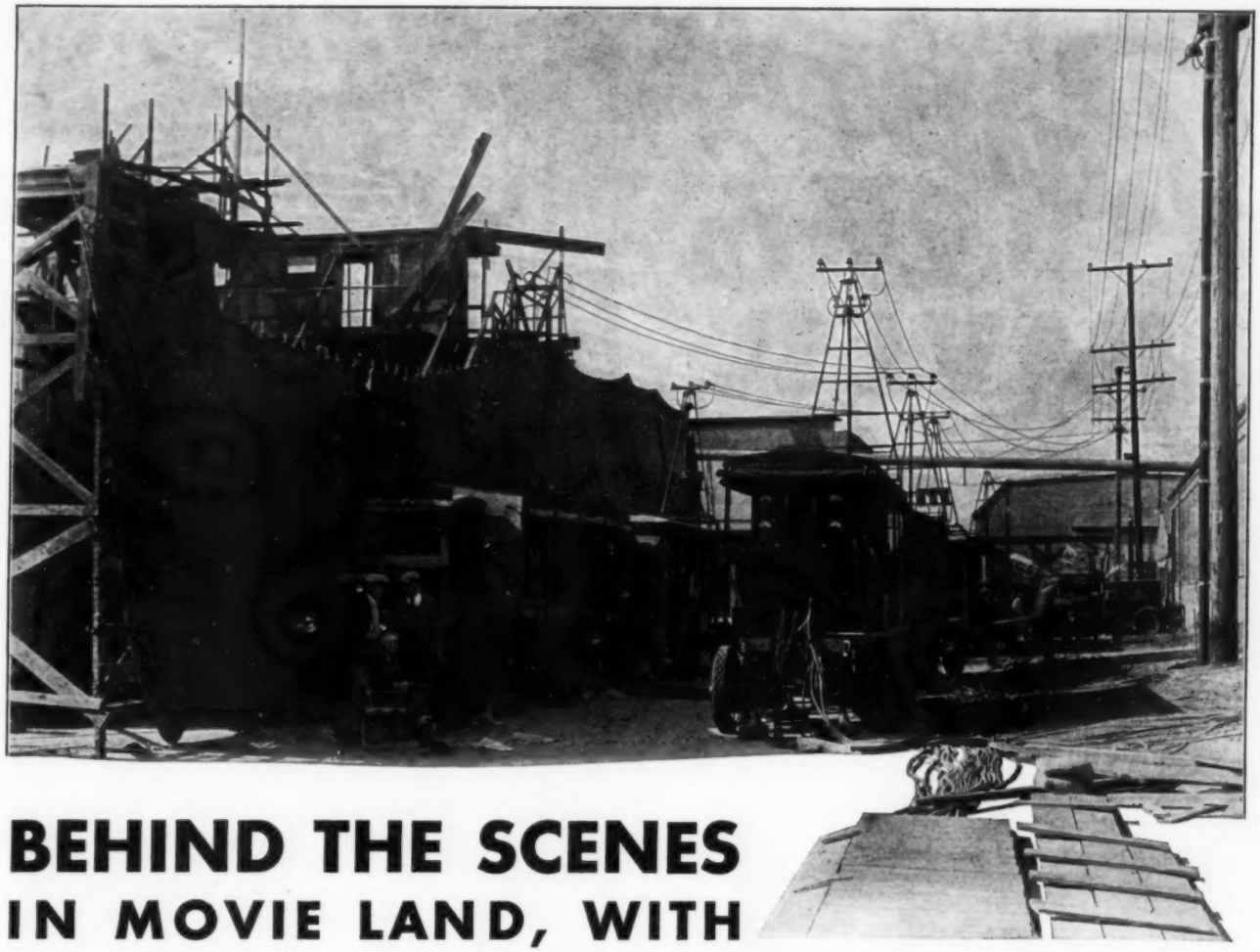
Do it with a General

The GENERAL EXCAVATOR COMPANY
375 ROSE STREET, MARION, OHIO
U. S. A.



General EXCAVATORS

SHOVEL - DRAGLINE - BACKHOE - SKIMMER - CLAMSHELL - CRANE - MAGNET



BEHIND THE SCENES
IN MOVIE LAND, WITH
ROME SUPER SERVICE

A busy day on a Hollywood lot. At a prominent studio—three companies at work on major productions.

Ten portable generating sets supplied current for lights and equipment using about 2876 k.w. The generators located far from the microphones necessitated portable power cable that would stand up without danger of failure to interrupt the "action" of costly actresses, actors, and equipment.

With wide experience as a guide, this studio standardizes on Rome Super Service cords and cables for both Electrical and Sound Departments.

You, too—whatever your work—will find Rome Super Service unsurpassed for any portable power application. Samples gladly supplied—make your own tests.

• • •

In dry docks, shops, mines—for lights, tools, welders, machinery—there's Rome Super Service cord or cable for any job. Tough, waterproof, flexible, resistant to oil and acid—Rome Super Service is ready for work, anywhere, any time!

GENERAL CABLE CORPORATION

420 Lexington Ave., New York City • Offices in Principal Cities

USE THIS COUPON • FREE SAMPLE

GENERAL CABLE CORPORATION
420 Lexington Ave., New York City

Send samples Rome Super Service, suitable for use on ..... No obligations.

Name .....

Street .....

City ..... State .....

Company .....

Ransome 27-E PAVER

with MAST PLANT

At work on a reservoir job

On bridge construction

On track elevation

This device is fully covered by basic patents

On many jobs the Ransome Paver with Mast Plant will bring the cost of mixing and placing the concrete down so that there is a nice profit even under the prices jobs are going at to-day.

One contractor told us "I figure your Paver with Mast Plant is saving me a dollar a yard."

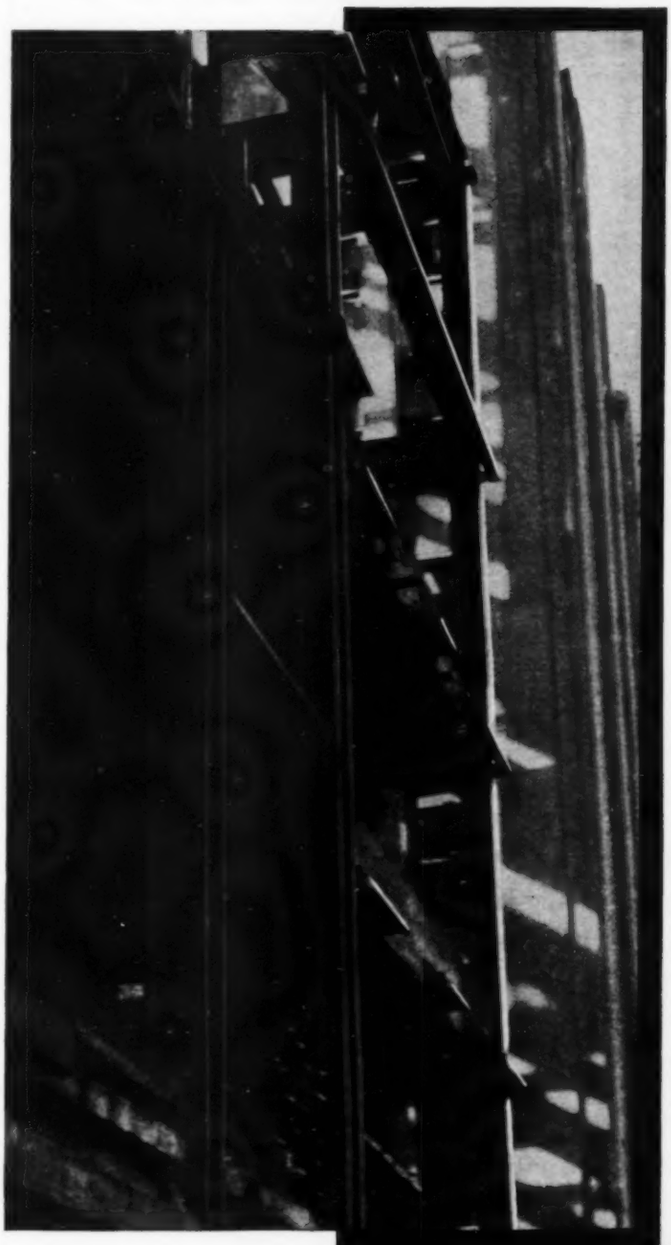
Write for a Bulletin

Ransome Concrete Machinery Company

1850—Service for 82 Years—1932

Dunellen **New Jersey**

EVERY OPERATION ON SCHEDULE.. ..... TO THE HOUR



HIGH early strength concrete saves money by releasing equipment more quickly for use over and over. Calcium Chloride is the contractor's first assistant in keeping concrete operations up to schedule. Its action is positive — definite.

Contractors should make sure that specifications include the use of Calcium Chloride in all concrete. It provides a mix on which finishers can go to work more quickly and permits continuous finishing. Every contractor should have Calcium Chloride available on every job—summer or winter, all year round.

Write for full information on Calcium Chloride for concrete construction. Literature explaining its use under various conditions may be had by writing any of the companies listed.

CALCIUM CHLORIDE ASSOCIATION

THE DOW CHEMICAL COMPANY
Midland, Michigan

THE COLUMBIA ALKALI CORPORATION
Barberton, Ohio

SOLVAY SALES CORPORATION
61 Broadway, New York City

MICHIGAN ALKALI COMPANY
10 East 40th St., New York City

CALCIUM CHLORIDE

FOR SAFE, YEAR 'ROUND CONCRETE CONSTRUCTION

CUT COSTS...BY USING PREFORMED WIRE ROPE

TODAY, EFFICIENT PRODUCTION IS OF UTMOST IMPORTANCE...

The above statement needs no amplification. Heads of industries know too well the need for judicious pruning of overhead costs. This is why users of wire rope check up on RESULTS... and why more and more each month, TRU-LAY is purchased in greater quantities. "All wire rope is alike" is no longer a buying index.

1 Cross your fingers like this. Feel the internal stress in your finger muscles.

This illustrates how strands and wires of ordinary (non-preformed) wire rope are subjected to a constant internal fatigue . . . because they are forced to hold their helical shapes.

2 Now move your middle finger. Note the rubbing action . . . demonstrating how, in ordinary wire rope, the ever existing straightening-out effort of the strands and wires causes excessive internal friction.

3 Let your fingers snap apart. Note how your fingers spread apart when you let them snap, as illustrated above. Strands and wires of ordinary (non-preformed) wire rope do the same when internal stress is released by removal of seizing.

ELIMINATION OF INTERNAL STRESS RESULTS IN 30% TO 300% INCREASED SERVICE WITH TRU-LAY . . . . .

Practically every use for wire rope is represented in our many testimonials on TRU-LAY, as compared with ordinary (non-preformed) wire rope service. These unbiased service comparisons—of ropes operating under identical conditions, proves in some cases as high as 300% increased service with TRU-LAY . . . never under 30%. *The size, style and material being the same, the increase in service with TRU-LAY must be due to its preformed construction.*

HOLD YOUR HANDS LIKE THIS

This simple analogy shows how the strands and wires of TRU-LAY lie together without stress. By preforming strands and wires to their exact helical shapes, there is no straightening-out tendency—no constant internal stress. The result is less fatiguing action, longer life, easier handling, greater flexibility, just to mention a few of the advantages of TRU-LAY.

Let us send you more facts. Address:

AMERICAN CABLE COMPANY, *Inc.*
New York Central Bldg., 230 Park Ave., New York, N. Y.
An Associate Company of the American Chain Company, *Inc.*
District Offices:
Atlanta, Chicago, Denver, Detroit, Philadelphia, Pittsburgh, Tulsa, San Francisco

ACCO

TRU-LAY PREFORMED WIRE ROPE

30% to 300% Increased Service [*Depending upon the character of the service and type of equipment*

PLANTING a Ground

★

32 MILES of No. 10 copper wire forms the "ground" of KGW's radio station in Oregon. A "Caterpillar" Thirty plus a Killefer subsoiler, plus an ingeniously mounted reel, fed the wire at a uniform depth 10 inches below the surface. Quick, inexpensive and a perfect "ground"! "Caterpillar" power is frequently used for laying light and power cable—and even pipe! Just once over and the trench is dug, the wire laid and covered up.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.
Track-type Tractors Combines Road Machinery
(There's a "Caterpillar" Dealer Near You)

Prices—f. o. b. Peoria, Illinois

FIFTEEN	$1100	THIRTY-FIVE	$2400
TWENTY	$1450	FIFTY	$3675
TWENTY-FIVE	$1900	SIXTY-FIVE	$4350
DIESEL	$6500		

★ CATERPILLAR

REG. U. S. PAT. OFF.

TRACTOR

Don't

tear up the street

Bore the hole instead of trenching

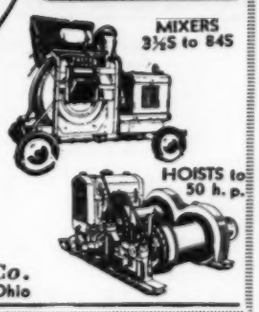
Antiquated trenching and pipe-jacking methods of installing underground pipe are costly and wasteful. The watchword of today is "Save with Safety" and Hydrauger completely fulfills those requirements. Open trenches have cost many lives through traffic accidents; cut-up pavements have already cost far too many dollars. Hydrauger finds daily use in many of the more progressive and efficient cities throughout the country. Complete information is in our Bulletin; send for your copy today!

HYDRAUGER CORPORATION, LTD.
1298 Bryant Street, San Francisco, Calif.

HYDRAUGER
"The Mechanical Gopher"

JAEGER
3" SELF-PRIME
CENTRIFUGAL

100% automatic priming at lifts over 25 ft., heads up to 60 ft., 5 h. p. gas or electric power, wght. only 400 lbs., Timken equipped. One of a complete line. Get our 1932 prices.



The JAEGER MACHINE Co.
800 Dublin Avenue Columbus, Ohio

DIETZ HIGHWAY FLARE TORCHES

What's the Difference?

Primitive man used a torch. A later generation developed the lantern—which is but a torch with a protected flame, fanned and fed by controlled air currents.

Development of the modern Highway Torch presents the same old difficulty of maintaining an exposed flame without blowouts.

Solution of the problem is wholly dependent upon the type of burner.

In this vital feature Dietz "All Weather Burner" makes the Dietz Torch outstanding for illuminating power and burning reliability. Dietz "All Weather Burner" includes a Rain Shield, which operates on a collapsible handle. The handle, in turn, serves for carrying purposes—also as a wrench when attaching or releasing the burner—or as an automatic wick lock or wick release, as occasion requires.

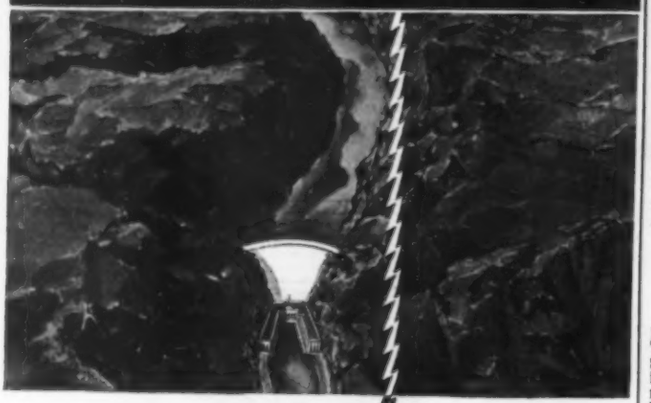
Dietz Torches provide full oil capacity. No. 96, pictured above, holds 3 quarts of oil. It is of heavy construction, with weighted bottom, enameled red.

SPECIFY DIETZ TORCHES
—there is a difference!

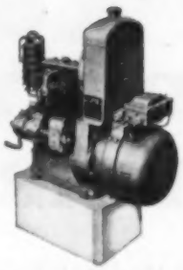
R. E. DIETZ COMPANY
NEW YORK

Largest Makers of Lanterns in the World
FOUNDED 1840

CONTRACTORS AT HOOVER DAM USE KOHLER ELECTRICITY



KOHLER Electric Plants, veterans of many engineering triumphs, are doing their bit at Hoover Dam — biggest government engineering project since the Panama Canal. R. G. Le Tourneau, Inc., one of the subcontractors, has specified Kohler Plants for use on steam shovels and other equipment to light night operations along the highway being built from Boulder City to the dam site. Lewis Construction Co., another sub-contractor, is lighting its entire construction camp with Model E Kohlers.



Kohler Electric Plants generate standard electric current at 110 or 220 volts A. C. or D. C. Capacities vary from 800 watts to 25 K. V. A. Gasoline or natural gas serves as fuel. Above is shown Model E—the kind in use on the machines at Hoover Dam.

In a region where water-power from the Colorado will one day generate current that surpasses today's output of Niagara Falls, Kohler Electric Plants are the sole source of reliable electric current! As Hoover Dam is a testimonial to the skill of modern engineering, so use of Kohler Electricity is proof of the efficiency with which these compact, portable, independent power-plants generate electricity — under any condition.

Have you an engineering problem in which Kohler Electricity could bring you economy and increased speed? A Kohler representative will be glad to discuss it with you, at your convenience, and without any obligation on your part. Or send coupon for detailed information about Kohler Plants in the engineering and construction field.

Kohler Co. *Founded* 1873. Kohler, Wis. — *Shipping Point*, Sheboygan, Wis. — *Branches in principal cities.* . . . Manufacturers of Kohler Plumbing Fixtures.

KOHLER OF KOHLER
ELECTRIC PLANTS

KOHLER CO., Kohler, Wisconsin

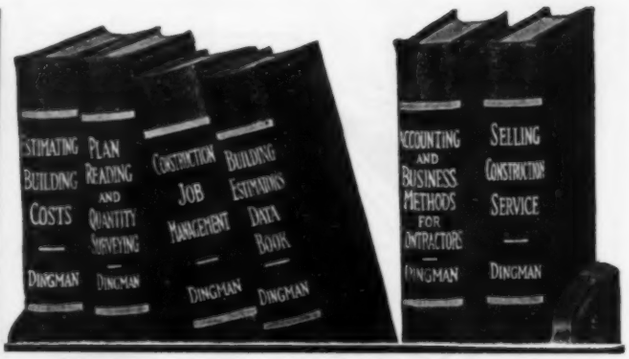
Gentlemen: Please send catalog describing Kohler Electric Plants.

Name _____

Street _____ CM-4-32

City _____ *State* _____

Use in which interested _____



Practical facts on every phase of building construction!

HERE is a Library of books that are packed to the covers with the best plans and methods for speeding up production, saving materials and labor, and cutting costs. These six books cover every phase of practical construction work from estimating building costs to the selling of construction service—from plan reading and quantity surveying to practical job management. With the aid of these books the contractor can get business in these dull times by learning how to make savings, and through them being able to make lower bids. The construction superintendent can learn how to keep costs down, which insures his job these days.

The Dingman Building Contractors' Library

The Dingman books have won a wide reputation among builders and building contractors for their sound, practical and easy-to-understand discussion of building construction work. All of the material has been drawn from actual practice.

This library is intended for

[1] The building contractor who wants a handy reference set that will give him almost instantly a ready answer to most of the problems that come up in the course of the day's work.

[2] The young men in the building industry who intend to make the business of construction their life work, and who want the kind of guidance that will aid them to climb to the top.

[3] Everyone in the building industry who wants to keep his job by increasing his usefulness and efficiency.

Each one of the volumes in this set is a complete handbook on some important subject. Sturdily bound and pocket size, it will go right "on the job" with you for immediate consultation.

Practical data is given on analyzing a construction job into its component parts—estimating the costs of labor, haulage, equipment, materials, etc. —plan reading and determining quantities from specifications—personnel management—successful supervision of every building operation—efficient and economical business methods—office procedure such as accounting banking, purchasing, etc.—advertising and selling methods for contracting service—and a complete data book of tables, forms and calculations most frequently used by the builder.

Free Examination—Small monthly payments

Without a cent of expense—without any obligation on your part—you may examine the Dingman Building Contractors' Library for 10 days and determine its value for yourself. Try the books out on your everyday problems—make them prove their worth to you. Unless they meet every test send them back at our expense. If the books prove satisfactory and you decide to keep them, pay only $1.50 in ten days and then $2.00 a month for six months.

Every contractor and builder, every architect and engineer, every student and executive, who is seeking practical help on the everyday problems connected with building construction work should have this valuable reference library.

McGRAW-HILL
FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 330 West 42d Street, New York, N. Y.

You may send me for 10 days' free examination, the new six-volume Dingman BUILDING CONTRACTORS' LIBRARY. I agree either to return the books at the end of 10 days or send a first payment of $1.50 then and $2.00 a month for six months.

Signed .....

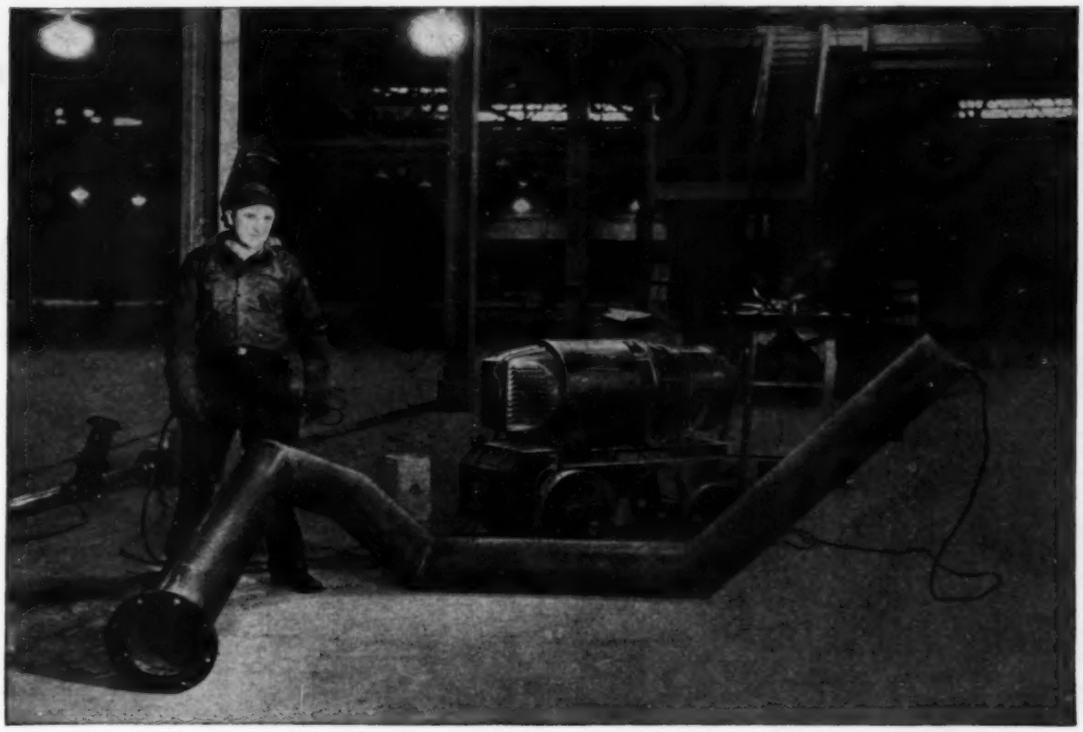
Address .....

City and State .....

Official Position .....

Name of Company .....

(To insure prompt shipment, write plainly and fill in all lines.) C.M. 4-32



"How do I like the New G-E Welder?

I can get *anything I want* out of it."

THE NEW G-E ARC WELDER

All the best features of all the good welders now on the market combined and excelled . . . plus features never before available.

1. Stable, flexible arc
2. Quick recovery ("pep")
3. Self-excitation
4. Spark-free commutation
5. Simple operation
6. Duplex voltage control
7. Dead-front control panel
8. Large, protected instruments
9. Light, compact, strong construction
10. Low center of gravity
11. A definite purpose for every ounce of material

"We're using your new machines and your heavy-coated electrode exclusively on this job and believe me you can't beat 'em," continued the operator.

"The job" is a new factory building in the city of Cleveland, which in addition to being arc-welded contains an arc-welded piping installation, which alone required one mile of welding.

If you want more evidence, we hope you will ask your welding distributor or nearest G-E office for a demonstration. Compare the new G-E arc welder with any other welder on the market. It is 'way ahead in welding!

530-123

GENERAL ELECTRIC

Pile Extraction

made easy with the

VULCAN EXTRACTOR

The Vulcan Extractor may be the most profitable tool of the contractors equipment. It is always ready to extract all the piling—steel or wood—regardless of weight or length.

The Vulcan Extractor is not a compromise tool; it is designed for just one job, extracting piles, and built to do that job well. It is just heavy enough for its job, without superfluous weight to be carried by the crane.

There is little lost energy with the Vulcan Extractor. Rigid metal side bars and links transmit all the energy of the ram to the pile. The ram itself is the only moving part in the extractor; there are no valves to wear and cause trouble.

The universal joint connection for the pile is a great convenience. The pile can be laid flat after extraction, and detached easily, without having to bother with twisted, kinked wire rope.

With the speedy and efficient operation of the Vulcan Extractor and the time saved by its greater convenience in handling, pile pulling is a really profitable operation.

VULCAN IRON WORKS
327 No. Irving Avenue, Chicago, Illinois

Southern Representatives:
Woodward, Wight & Co., Ltd.,
451 Howard Ave., New Orleans, La.

Representatives for the States of Washington and Oregon:
A. H. Cox & Co., Inc.,
1757 First Avenue, S., Seattle, Washington

Representatives for California, Nevada, and Japan:
Harron, Rickard & McCone Co.
1600 Bryant St., San Francisco, Calif.

THE VULCAN EXTRACTOR

A Western No. 6 Elevating Grader and Western Crawler Wagon on an airport construction job.

A Western No. 6 Elevating Grader, casting a road.

Leading Western Crawler Wagons "in train" with an Austin Contractor's Special Elevating Grader.

MOVE MORE DIRT FASTER AND CHEAPER

Where projects involve the moving of thousands of yards of materials, where the ultimate in speed is a consideration, where *lowest* possible cost is of prime importance, there the elevating grader and its companion equipment, the crawler wagon, find their ideal application, forming as they do the fastest and cheapest known method of digging and moving vast quantities of materials.

In the Austin-Western Line of elevating graders is found the highest development of the elevating grader idea, originated in 1866 by Austin and now expressed in the Austin Contractor's Special 42-inch and 48-inch Carrier Models and the Western No. 6 Elevating Grader. In each unit are developed features desirable to the individual machine—sturdiness, easy turning, elevator height adjustment, a deep cutting plow, the free use of anti-friction bearings, simple power takeoff or engine carrier drives and many other design advantages.

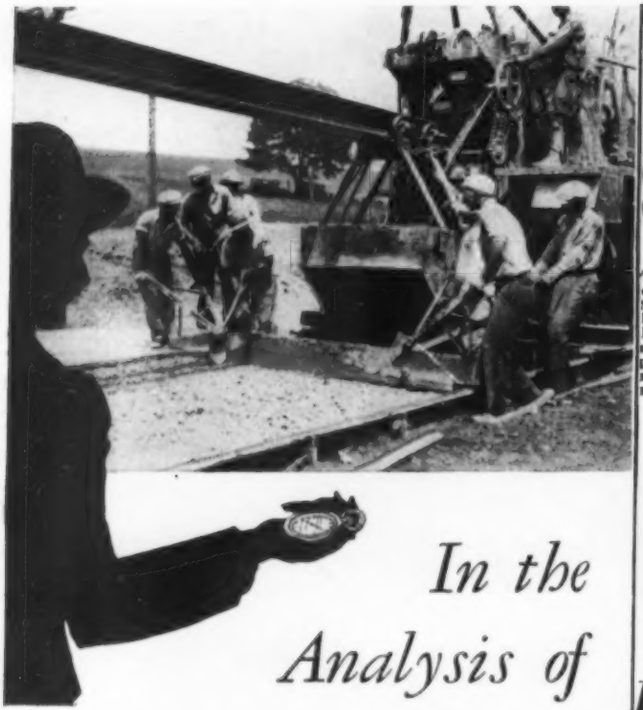
Full description and illustration details are contained in special bulletins sent free on request—Bulletin No. 1237 on Austin Contractor's Special Models and Bulletin No. W-31-C on the Western No. 6 unit. Send for copies and get first hand information on these modern, fast, low cost, earth moving machines.

The Austin-Western Road Machinery Co., 400 North Michigan Avenue, Chicago, Illinois.

333

The Austin-Western ROAD MACHINERY CO.

ROAD ROLLERS, CRUSHING & SCREENING PLANTS, SCARIFIERS, SWEEPERS & SPRINKLERS, ROAD GRADERS, ELEVATING GRADERS. MOTOR GRADERS, PLOWS & SCRAPERS, ROAD OILERS, ROAD DRAGS, CULVERTS, SHOVELS & CRANES, DUMP WAGONS, SNOW PLOWS.



In the Analysis of

JOB OPERATIONS *use a* STOP-WATCH!

In a recent report of the U. S. Bureau of Public Roads, stop-watches were indicated as important units in the road building and construction fields.

•

The report mentions: "Data were obtained by means of careful daily stop-watch studies of all operations . . ."

•

The use of a Guinand or a Gallet Stop-Watch will achieve great economies in planning and doing the job. Write for a catalog showing these highly dependable stop-watches.

GUINAND AND GALLET STOP-WATCHES

STANDARD THE WORLD OVER

•

Illustrated: No. 302 Gallet Time Study Production Stop-Watch

Jules Racine & Co.,
20 West 47th St., New York, N. Y.

Kindly forward your catalog CM-4 on Stop-Watches for Industrial Uses.

Name .....

Address .....

City ..... State .....

Want Stop-Watch to Measure .....

EVERY FOOT TO SPECIFICATIONS!

Two Ingredient Beam Scale used on bridge job near Decatur, Illinois. Note how platform is arranged for rapid work.

Fairbanks Wheelbarrow Scale on culvert job near Wheeling, Ill.

by this accurate method of controlling the mix

Simple! Charge the mixer with accurately *weighed* proportions of the aggregates. Then you know the mix will meet with your contract specifications. And as long as you have your men trundle each wheelbarrow of aggregate over a Fairbanks Wheelbarrow scale, you know each succeeding mix is just like those that have gone before it.

Equipped with Ingredient Beams, you can handle three different weights of three different aggregates over the same scale. The scale is easily portable—springless—and the quickly readable Over and Under Indicator permits speed with accuracy. Fairbanks Wheelbarrow Scales comply fully with American Road Builders' Association Standards.

There are three types. Detailed information upon request. No obligation.

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., Chicago, Ill.

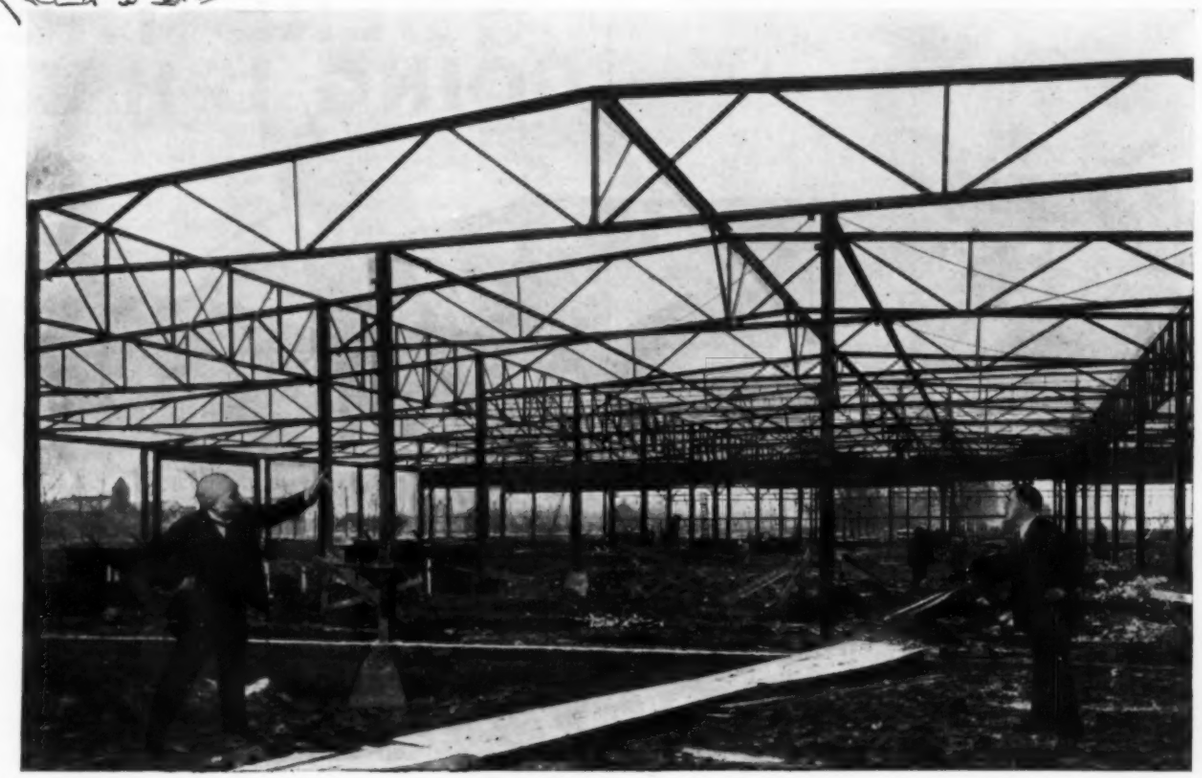
And 40 principal cities—a service station at each house.

This Two Ingredient Scale weighed all stone and sand for bridge on Route 72 west of Genoa, Ill.

Fairbanks Scales

5667-SA31.7

POP AND LAD INSPECT AN ARC-WELDED MILL BUILDING



"Now here's modern mill building construction. It's arc welded!

"Look at those trusses . . . no gusset plates . . . no punching . . . all loads transmitted direct from one member to another.

"This arc welding certainly simplifies design and fabrication, which means less tonnage and lower fabrication costs."

"Right . . . and that's corroborated by the fabricator who reports that when properly designed he can fabricate and erect by arc welding for less money than by traditional methods.

"And he told me that this job will be 100% arc welded, meaning framework, roof, stacks, piping, doors, boilers, tanks and furnace shells.

"Just another example of the ever-increasing use of arc welding due to the pioneering in arc-welded structural design and its application, and the manufacture of better welding equipment by *arc welding headquarters,* namely

LINCOLN

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Largest Manufacturers of Arc Welding Equipment in the World

W-14

Re-line with Ebonite XL

the brake lining selected by P&H (Harnischfeger Corp., Milwaukee, Wisc.) and other leading manufacturers, for heavy-duty brakes and clutches

EBONITE gives a better brake and far longer service for it embodies the best features of all types—is woven, molded and compressed, and in addition is *integrally compounded*—impregnated from within, out (patented Ebonite process). Because of this process, Ebonite contains more braking substance, greater frictional qualities, holds its firm, soft braking characteristic till worn out. Ebonite absorbs less water or oil, runs cooler and *does not carbonize*—the prime cause of brake drum scoring.

Specify Ebonite

for shovels, hoists, draglines, tractors and trucks; and, if it doesn't give more satisfactory service in every way, than any other lining you have used, ship it to us and we will replace it without charge.

L. J. MILEY COMPANY
INCORPORATED
1852 S. Michigan Avenue, - Chicago, U.S.A.

USE IT ANYWHERE WHERE THE GOING IS HARD

On exposed gears . . . DIXON'S clings to the teeth providing a protective coating that greatly reduces friction.

On wire ropes . . . the graphite penetrates the strands, thoroughly lubricating them.

On pump plungers . . . it coats the surfaces with a film of graphite, decreasing friction and extending the life of the equipment. On any exposed equipment . . . it prevents rust.

DIXON'S Waterproof Graphite Grease maintains a wear-resisting graphite surface between parts that otherwise would be in metallic contact. It is remarkably adhesive without being gummy or sticky. Water will not wash it off. It is unaffected by sea water, alkaline or acid waters. It is the ideal lubricant for heavy service.

DIXON'S WATER-PROOF GRAPHITE GREASE

Other DIXON Products

Flake Graphite
Graphite Seal
Graphite Cup Grease
Pipe Joint Compound
Belt Dressing

Joseph Dixon Crucible Company

Jersey City — New Jersey

105 YEARS OF — GRAPHITE EXCELLENCE SINCE 1827 — DIXON SERVICE

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED—RATE PER WORD:
Positions Wanted, 5 cents a word, minimum $1.00 an insertion, payable in advance.
Positions Vacant and all other classifications 10 cents a word, minimum charge $2.00.
Proposals, 50 cents a line an insertion.

INFORMATION:
Box Numbers in care of any of our offices count 10 words additional in undisplayed ads. Replies forwarded without extra charge.
Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:
1 inch.....$6.00
2 to 3 inches.....5.75 an inch
4 to 7 inches.....5.50 an inch
Other spaces and contract rates on request.
An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL 10 A. M. ON THE 2ND FOR THE ISSUE OUT THE 9TH OF THE MONTH. C.M.

SALESMEN AVAILABLE

SALESMAN, calling on plumbing and heating dealers, architects, etc., in Wilkes-Barre, Pa., and vicinity for fifteen years, is available for side lines.—Building hardware specialties, etc. SA-104 Constr. Methods, 330 West 42d St., New York.

ALPHABETICAL INDEX TO ADVERTISERS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Construction Methods* assumes no responsibility for errors or omissions.

SEARCHLIGHT SECTION

Classified Advertising

DIGGING SUBWAYS

THE COUNTRY'S LEADING SUBWAY CONTRACTORS OWN AND USE MORE THAN 150 OWEN BUCKETS

Atwell, Gustin & Morris
Carleton Company
Clemente Contracting Co.
P. J. Cogan
Cornell Contracting Co.
Corson Construction Co.
Culver Contracting Co.
Di Marco & Reiman
Geo. H. Flinn
Goldberger Raabin Co.
Golder Construction Co.
Hart & Early
Heyman & Goodman Co.
Henry W. Horst Co.
Jaffola & Mark
Arthur A. Johnson
Keystone State Corp.
LaRocco Contracting Co.
J. & R. Lombardi
Patrick McGovern
Marcus Contracting Co.
Mason & Hanger
Mideastern Contracting Co.
Moranit & Raymond
Necaro Company
Oakdale Contracting Co.
Joe Rosenthal Eng. Co.
D. C. Serber
Thompson Leopold & Fredburn
Triest Contracting Co..
Underpinning & Foundation Co.

Subway construction is difficult work and demands equipment that will guarantee maximum output and uninterrupted performance. Subway digging is primarily a question of moving a lot of material and *moving it fast!* Owen Clamshell Buckets are used on practically all the subway construction jobs in America.

THE OWEN BUCKET CO., CLEVELAND

Owen Buckets

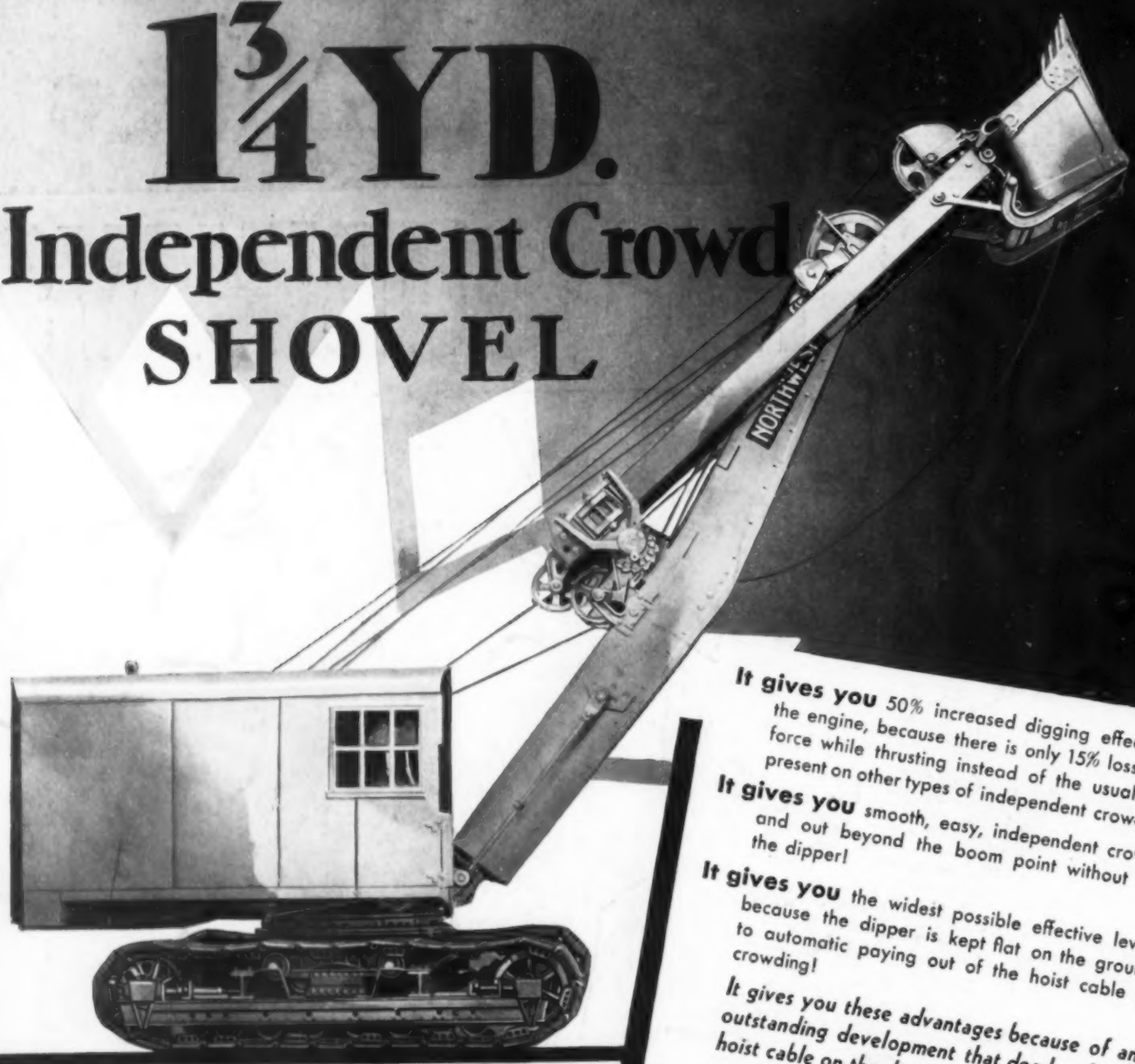
A MOUTHFUL AT EVERY BITE

NORTHWEST

announces a new

1¾ YD.

Independent Crowd SHOVEL



It gives you 50% increased digging effectiveness of the engine, because there is only 15% loss of digging force while thrusting instead of the usual 45% loss present on other types of independent crowd shovels!

It gives you smooth, easy, independent crowding up and out beyond the boom point without lowering the dipper!

It gives you the widest possible effective level floor because the dipper is kept flat on the ground due to automatic paying out of the hoist cable during crowding!

It gives you these advantages because of an outstanding development that dead ends the hoist cable on the dipper sticks instead of at any other point. Northwest effectively utilizes a force that is wasted on other shovels.

THE GREATEST VALUE PER DOLLAR OF ANY SHOVEL ON THE MARKET!

NORTHWEST ENGINEERING CO.
1728 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill., U. S. A.

CM4Gray

—with the Patented Cable Crowd no other manufacturer can offer!